

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXXVI.

May 22, 1937

No. 934

Business Development

THERE is usually a tendency in times of good trade to extend businesses, frequently without sound justification. It is one thing to invest idle capital in the further expansion of a business, and it is quite another to increase capital to finance expansion that may not be maintained when trade slackens. The continued expansion of the British steel trade is quite justified in so far as the steel companies are all investing their capital in the restarting of idle plant, or in installing new plant that will make their works and processes more efficient. The same applies to all other businesses that are expanding, but it is to be hoped that there will be no frantic multiplication of factories and workshops such as occurred during the 1914-1918 period, when this country turned out munitions of war on the large scale. If new plant is installed on this basis, we suggest that when the probable profits are calculated in advance, a very heavy depreciation figure should be included—not less than 20 per cent. in many instances—so that if the market should not remain when the rearmament programme is finished, there will be no painful problem of beating swords into ploughshares, as there was between 1918 and 1930.

In considering the development of factories, it is also necessary to consider business development. Times of good trade are wont to be times of extreme optimism, when men sometimes engage in ventures for which they are unsuited. All will remember the rationalisation craze after the war—but it was no new development. It had had its origin at least as far back as the 'nineties, and had perhaps reached its peak in America. It was carried both here in the 'nineties and in America always to the extreme of buying up even the businesses that used the products of the parent business in order to safeguard markets. In America there has been a reaction in the public attitude to the Big Business. The American public is apt to go to extremes in its opinion—to blame bigness as bigness for ills when times are bad, and to devote to the idea some of the ecstatic admiration given to the sky-scraper when times are good. America is the home of big things, but many do not always distinguish between what is valuable, and what is worthless, or at the very least—less valuable.

The manufacturing corporation which has found it necessary to buy up producing, wholesale and retail concerns in order to safeguard supplies, and an outlet for its products, would probably be stronger without its supporting concerns. The whole concern is ill-balanced, and the directorate must inevitably be engaging in many businesses that they do not understand. In England this system of rationalisation (if that be the right word) is unusual, although it will not

be forgotten that in the 'nineties there was a scramble on the part of breweries to buy up public-houses in order to force the sale of their product. To-day, most British businesses, and notably the chemical industry, are developing on sound lines. The businesses that are bought up are only such as are genuinely similar in character to the parent business, or that supply essential raw materials, or possibly that use the main product as a raw material for yet other products. We have little fear of the future of British basic industry so long as the enlargement and concentration now recognised as essential continue to proceed on present lines. The gas industry is concentrating the ownership of its works in fewer hands, the iron and steel industry is concentrating production of pig-iron, coke and steel in self-contained works, the collieries are amalgamating one with another, and the organisation of Imperial Chemical Industries, Ltd., in our own field is another example of well-regulated development.

There is always a temptation in times of good trade to launch into further business, and to manufacture products not hitherto made. Here again there should be caution and careful market research before the new product is made. It is not sufficient to be able to take a share from an already well-supplied market. Competition is good, but if competition becomes so severe as to encourage disastrous price cutting when times are less good—which happened freely during the recent slump, particularly in the engineering trades—then competition is bad, and results only in the ruination of all. The attitude both of those who rush into new lines of business without adequate market exploration, and of the public who support them is aptly illustrated by the story of the workman who one Monday noticed a gang of men laying a cable in the public highway. On the Wednesday morning the foreman went round with his time-sheets. All but one were accounted for. Not remembering him, the foreman asked: "Who set you on?" To which the man replied: "Well, I saw all those chaps a-digging, so I thought as I might as well start too." The foreman was so astonished by the man's cool cheek that he went away and made out another sheet; in that respect, the foreman resembles the public. But let it not be forgotten that when the job was done, that man who forced his way on to an already full market would be the first to be dismissed. It is often so, and the more reputable firms will do business in times of bad trade with their old friends, even though difficulties of delivery may have caused them to go elsewhere for a time when all were busy. It is important, in short, for business expansion to be on sound lines, based on a genuine market for the product manufactured.

Notes and Comments

Co-operation for Safety

NEW discoveries and new processes in industry call for constant vigilance to ensure that new and unsuspected risks are not imposed upon the persons employed, and it is well that the Factory Department of the Home Office should remind manufacturers of the need for satisfying themselves that their safety and welfare provisions keep pace with progress. When the utmost precaution has been taken there remains one essential in the promotion of health and safety, and that is co-operation—co-operation not only between employers and workpeople, but also, under the new Factory Bill, between the maker of the plant and the company and the individual using it. Colonel Garrett, the deputy chief inspector of factories, told an industrial safety conference the other day something about the agreements already in force for the promotion of uniformity in safety methods, but such agreements need constantly to be examined in the light of new processes, and to that end there must be a regular pooling of knowledge. The British Chemical Plant Manufacturers' Association and the Association of British Chemical Manufacturers can and do contribute in large measure to a clearer recognition of the importance of safety in the works and it is reassuring to find the Factory Department increasingly anxious to apply the knowledge gained by long experience to the prevention of repetitive accidents.

Expanding Overseas Trade

THE figures for Great Britain's overseas trade last month slightly exceeded the record levels for March, which were the best for six years, and the increase in exports over April of last year was the greatest for any one month for several years, mainly owing to heavy sales of manufactured goods. Every one of the 20 categories into which exports are divided in the Board of Trade returns showed increases last month, the figures for chemicals, drugs, dyes and colours showing a rise of £535,662. For the first four months of 1937 the total exports of chemical products increased by £1,329,938, or over 19 per cent. over the corresponding period of last year, principally on account of heavier shipments to India, China, Belgium, Scandinavia, New Zealand and British Malaya. Exports of sulphate of ammonia have risen from £411,847 in 1936 to £539,992 in 1937, and copper sulphate has jumped from £158,338 to £248,027. Despite the suspension of exports to Spain, British exports of dyestuffs during the four months showed an increase from £365,800 to £442,725. Imports of chemical products, which were £106,113 higher in April than a year ago, have increased by £240,767, or 5½ per cent., for the four months over the corresponding period of 1936. Purchases from South Africa were more than doubled, and there was a substantial rise in imports from the United States; on the other hand imports from Germany show a decrease from £1,312,337 to £1,279,133. Total imports of dyestuffs for the four months amounted to £461,878, compared with £512,880 last year. In view of the steps that are being taken towards the establishment of a calcium carbide industry in this country it is of interest to note that 427,422 cwt. of carbide, valued at £237,176,

was imported into Great Britain during the first four months of 1937, compared with 382,516 cwt., valued at £213,895, in the corresponding months of 1936.

Private Trade in Arms

THE White Paper in which the Government announces how far it is in agreement with the conclusions and recommendations of the Royal Commission on the Private Manufacture of and Trading in Arms finally disposes of the suggestion made while the Commission was sitting that a State monopoly should be substituted for private enterprise. In conditions of modern warfare the need of the country on the outbreak of war is for a system which ensures the most rapid and effective mobilisation of the whole of the industrial resources. Neither State enterprise nor private industry can alone secure the position; it can be secured only by the utilisation of both and by the greatest measure of collaboration between the State and private industry in peace time. When Lord (then Sir Harry) McGowan appeared before the Commission in February last year he advocated the establishment of a permanent supervisory body for the co-ordination of private manufacture and the Commission in due course recommended the appointment of a single Ministry of Supply. The Government, however, has decided that such a ministry is not required, in peace, in the public interest, having regard to the measure of co-ordination already achieved. The whole of the existing organisation is at present working at high pressure on the defence programme and the opinion of the Government is that sweeping changes would delay progress and could only be justified by the strongest grounds of public interest which the Government as at present advised, is unable to discover.

Helium or Hydrogen

UNTIL full investigation has been made it will be impossible to account for the recent Hindenburg disaster, and in that investigation we imagine the chemist will take a not unimportant part. We believe that when the great airship was under construction the intention was that its sixteen gasbags, with an aggregate capacity of some 7,000,000 cu. ft., should be inflated with that comparatively non-inflammable gas, helium. Partly because of the cost in money and in diminished pay-load of helium, but chiefly because the only considerable supplies of helium were to be found in the United States and were needed by that country for the experiments of its naval airship department, the Hindenburg was inflated with hydrogen at the time of the disaster. It may be found that the particular form of gas employed had but little to do with the accident or that in any case the substitution of helium for hydrogen would have been an economically impossible proposition, considering that the latest estimate of the cost of producing helium is somewhere in the region of £5 per thousand cu. ft. It is not without significance, however, that as a direct result of the disaster the United States Senate took steps to facilitate the consideration of a Bill intended to strengthen Federal control of the production, sale and use of helium.

Getting Extra Efficiency from Chemical Plant

By A. G. WRIGHT

TO be a good investment chemical plant of a general nature should be adaptable, in addition to being efficient.

It must also allow the adoption of rigid methods of control as and when the occasion arises. Maintenance costs must be low, or at least proportionate to the duties which are performed, for all plant does not experience the same degree of deterioration from mechanical wear and tear, and by corrosive influences. Safety features are also necessary, on the one hand to cover fire and explosion and general health hazards, and on the other hand to reduce material damage to the plant itself whilst in operation. Safety, however, does not alone depend upon safety devices; there must be a carefully thought-out scheme for the flow of material through the plant, with a consideration of the contingencies which may arise in connection with chemicals (including gases), temperature, pressure and a sudden increase in quantities of material.

Filtration processes which do not give the desired clarity of liquid should be carefully reviewed, because they sacrifice a quality that no amount of added operating speed can replace. There is also a point beyond which an increased rate of flow is much to be desired, although the first evaluation of any filter aid must be made on its clarifying efficiency. Recognising the need for sharper filtration in some products than in others, different standard grades of filter aids have been perfected, each with different rates of flow and clarity characteristics. A number of special grades are also obtainable to meet individual filtration problems.

Pumps, Filter-Presses and Centrifugals

A truly non-leakable filter press can be produced by caulking the filter cloth into a groove inside the packing with a special kind of rope and then placing a gasket between the plates. Such a filter press combines all the advantages of the recessed-plate type and the flush plate-and-frame type. Frames are eliminated, the cloth is held flat and therefore lasts longer, and the cloth area which is required for a definite filtering capacity can be smaller.

Consider also the matter of pumping liquids to filter presses and centrifugals. An efficiency curve on a pump will tell a lot about what the pump will do under given operating conditions, especially in cases where the pump is feeding a centrifugal. The centrifugal, moreover, should have an internal streamlined design where water flows with the least resistance, well rounded cutwaters, and smooth passages from intake to discharge. Motors and pumps should be built to work together, and purchased under one responsible guarantee.

For the large-scale filtration of mixtures which carry much solid matter, a drum filter has been developed in which a preliminary filtering operation takes place on the inner side of the drum, after which the cake is mechanically removed and washed, and then once more filtered on the outer side of the drum. Easy removal of the filter cake from the drum has been achieved by providing for a system of cords or a band passing over the drum and over an auxiliary roller. In this way the material is removed continuously and very much more quickly than has been possible by scrapers. In a modification of this principle, the band can be considerably lengthened and led through a form of drying oven where the material becomes dry and falls off.

Clean compressed air is needed at most chemical works for agitating purposes or for pressure displacement, and also for maintaining the pressure on storage tanks. The fine quality of a chemical product is partly assured by using a compressor which delivers clean air, free from dust or oil.

The sifting centrifuge represents a relatively new application of centrifugal force for the separation of materials. In this equipment cylindrical sifting and filtering members are provided in the form of a centrifuge so that they

continually throw off the particles which normally settle and choke the filter cloths. In consequence it becomes possible to filter thick liquids through cloths with 25,000 mesh per sq. cm.

Improved types of cyclones are now collecting dust from waste gases and also the fine powders produced in many chemical and physical processes. The dust collecting capacity of a cyclone will vary with the size, shape and character of the dust. Some cyclones, however, are extremely simple in construction, direct in action, compact and flexible as to capacity. With an all metal construction they are fireproof and weatherproof, and suitable for hot, cold, dry or moisture laden gases. Cyclones can be installed in spaces not suitable for other use, either inside or outside of buildings.

Construction of Autoclaves

Experience, resourcefulness in design and modern constructional facilities are necessary to produce autoclaves which can operate successfully under modern conditions of pressure and temperature. When in need of an autoclave it is especially desirable to go to a maker who knows not only what should be done, but also what is to be avoided; not all makers give painstaking attention to details of design, and thorough and proper methods of testing. Autoclaves and boilers are now manufactured in which the heating jackets are connected with the heated outer wall by means of numerous welded members, like stay-bolts, so that the intermediate heating space with a thin outer wall can withstand pressures up to 75 atmospheres (1,100 lb. per sq. inch).

Like all machines, valves are subject to wear on the moving parts. With a minimum number of working parts, rugged construction, and simple but perfect means of lubrication, however, friction can be reduced to a negligible item, especially in plug valves. Wherever leaks might be costly or dangerous, lubricated plug valves will give long and dependable service at the lowest possible operating cost. Valve design, moreover, has kept pace with the latest developments of technical chemistry and has brought out special types of construction. Gate valves are now adapted to meet every demand which is likely to be made by variations in the type of a material or its physical state, *i.e.*, from light gases of great volume to viscous colloids.

Losses Due to Leaky Valves

Thousands of valves may be in evidence at a large plant, on pipe lines, accessories, and various pieces of equipment. Little leaks in these valves on the compressed air, steam and water lines can reach a high total in the course of a year. Good quality valves and boiler mountings offer every plant the opportunity of eliminating such costly leaks. Substantial savings are also reflected in the reduced labour costs of repairs and replacements, and in the higher operating efficiency and increased production of the plant. Even a leak of one thirty-second of an inch in diameter will pass 52,910 c. ft. of air per month, when the pressure is 75 lb. per sq. inch, and at a cost of 5½ per million c. ft. this waste will amount to over 24s. per month. A similar leak in respect of steam will pass 4,790 lb. of steam per month at 160 lb. working pressure; 5,990 gallons of water per month at 60 lb. pressure. When the leak is equal to a hole one-sixteenth of an inch in diameter the cost of wasted compression air will increase to nearly £5 per month.

The flow of steam at a pressure of 100 lbs. per sq. inch will vary 1 per cent. in quantity each time the pressure varies by 2 lb. per sq. inch. A flow of air or gas at the same pressure, will vary 2½ per cent. each time the pressure varies by 5 lb. per sq. inch. The use of pressure-compensating flow meters will protect the plant user against metering the errors which are caused by such pressure variations. These meters are available for steam, gas, air, water and other liquids.

Water gauges for pressures up to 300 atmospheres (4,270 lb. per sq. inch) and condensate traps for operation under pressure of up to 250 atmospheres (3,560 lb. per sq. inch) are now available. Pipes and tubes have also been further developed in all their applications. Wrought iron gilled tubes with smooth laminations have been produced with a heat transfer which is 21 per cent. higher than that of ribbed tubes. They can find a wide application in the construction of heating at cooling systems.

The past thirty years have proved that an insulating material made of clean cork granules, properly applied and maintained, will provide a lifetime of insulating efficiency on brine and other cold pipe lines. In many cases of severe service, cork covering has outlasted the pipes to which it has been applied. Not only does cork successfully bar the passage of heat, but it prevents the infiltration of moisture which conducts heat and causes failure. In other words, the natural cellular structure of cork makes it a permanently efficient insulation material because of its low thermal conductivity and high moisture resistance. Two other important physical qualities of cork coverings are precision fit and rigidity. Each section of the covering can be machined to the exact dimension of the pipe it is to insulate, and the rigidity of cork will then eliminate any inefficiency due to sagging from the lines. These particular features of cork can prevent the formation of moisture-catching air pockets and assure efficient service.

Splash-Proof Motors

Costing only a little more than standard open-type motors, a modern splash-proof motor assures the maximum protection wherever splashing water is present. With a motor which is really splash-proof, it is not possible for splashing or dripping water to enter from any angle whatever. Such a motor is ideal where the continual washing down of plant is necessary.

Slipping belts and clutches, mis-aligned shafts, leaky valves and fittings, and other losses of power are not tolerated in a modern chemical works. They are too costly. It is necessary, however, to keep an equally tight rein on maintenance costs by giving special attention to lubrication.

There are many materials that can be more cheaply and safely conveyed by air than by any other method. For instance, pulverised coal. Installations are in existence where the conveying lines extend all over the plant up to 1,500 ft. from the central station; at such an installation in the United States the conveying cost is only 6 to 8 cents per ton. Consider, therefore, the economy, efficiency, and cleanliness of unloading and conveying bulk chemicals by air, through pipe lines connected with storage and process bins. Several kinds of material can be handled alternately without danger of contamination, as self-cleaning air conveying systems are procurable. In addition, there are no dust hazards, and workmen are not exposed to the danger of dusts which may give rise to silicosis. Materials can be conveyed by this system wherever it is possible to lay pipework. Warning signals can be installed at the unloading point to indicate when the bins are full.

Batches by Automatic Weighing

In combination with new mechanical devices such as photo-electric cell cut-offs, electric relays, and other controls, automatic scales are now preparing and measuring the ingredients of batches of material in many industries. The scale pointer swings as the hopper is loaded, a click indicates the closing of the relay as a pre-set weight figure is reached. Whenever such scales are in operation, attendance costs are reduced, uniformity between batch and batch is insured, and the operating efficiency of the entire batching system is kept high. Bin level indicators placed 12 inches from the top of each bin, can automatically close the intake valve and shut off the compressed air supply to prevent overfilling. In addition, it is possible to provide a device which automatically registers the weight of material conveyed to any given storage bin or vessel throughout the plant.

Coming to the subject of constructional materials it may be stressed that many plant users hesitate to take full advantage of stainless steel because of the question of cost. Actually, careful planning can keep down the first cost of stainless steel equipment, and on the basis of ultimate cost the figures are often surprisingly low. By designing for the higher tensile strengths of stainless steels it is possible to use lighter sections with equal safety. Some types of stainless steel cost much less than others, so that if one of the lower class alloys will provide all the corrosion-resistance needed, another important saving is effected. With stainless steel equipment this is also a saving on cleaning expense. The metal cleans easily, stays cleaner, reduces any loss of time needed for cleaning. The high heat resistance of stainless steels permits the use of temperatures and pressures otherwise impossible. The makers of the steel can help to reduce first-cost by recommending the most economical alloy for specified purpose, and by suggesting the most economical shapes and dimensions for easy fabrication.

Nickel Clad Steel

Chromium steels resist the attack and prevent the contamination of a wide variety of corrosive commercial chemicals. They are immune to many acids and salts, even when continuously exposed to high temperatures. Chromium steels therefore merit careful consideration in the design of processing equipment. Their use minimises replacement and maintenance, insures against the contamination of the product, and lessens the danger of spoilage. Reduced manufacturing costs and purer products over the result.

For heavy equipment nickel-clad steel gives all the corrosion-resistance of pure nickel. When an 8,000 gallon tank-car is built to carry phenol as to the United States, it is very necessary to think in terms of cost per pound of the metal that goes into it. At the same time, a metal which throws rust or harmful metallic contamination into the product must not be used.

In such cases nickel-clad steel plate is supplied. The 10, 15, or 20 per cent. layer of pure nickel is the only surface that touches corrosive acids or alkalis. It is not true economy in plant cost to pay the price of a corrosion-resistant material for the 80 or 90 per cent. that never touches the product. The cost per pound of nickel-clad steel equipment runs from one-third to one-half of that for pure nickel. The nickel-clad steel, moreover, acts like a solid metal. It can be fabricated by all standard methods, including welding and combinations of riveting and welding. The two metals remain permanently bonded under all normal stresses of fabrication. Such a metal has all the heat conductivity of either solid steel or solid nickel.

Wire Cloth for Quick Draining

The immersion of flexible wire cloth in water, oils and chemicals does not impair its operating reliability, or durability, for such cloth can be woven in any ductile metal which is most resistant to plant conditions. Countless weaves, sizes of openings and wire diameters are available to meet operating requirements. These unprecedented characteristics may permit easily a new, continuous, processing belt application, which will save time and money in conveying "something" into or out of a liquid bath, or through a liquid spray, under a steam jet or a compressed air jet. Such wire cloth belting is quick draining.

The heat resistance of acid proof enamels has been enormously improved during the last few years. Specially thin layers of rubber are now made, which is also an important advance in respect of the transfer of heat. Synthetic resin mixed with fillers and stabilisers has become an important constructional material, where high mechanical strength is combined with good resistance against the action of chemicals and heat. A few years ago the choice of refractories would have been limited to a "hard burned" or a "soft burned" fireclay brick. To-day, however, there is a wide variety of common refractories from which to choose.

Platinum and Allied Metals

Some Points of Interest to the Chemical Engineer

DURING the past twenty years there have been some very important changes in the platinum industry, not least of which is the growing importance of the production of platinum from primary deposits. Whereas in 1915 the output of platinum from alluvial deposits was more than 95 per cent. of the world production, by 1934, although final figures are not available for all countries, it is certain to be well below 50 per cent. There is every indication that the alluvial deposits will diminish in importance as the richer deposits are worked out, and that future requirements will be supplied largely from primary deposits according to a paper on "Platinum and Allied Metals" read jointly by Mr. C. Johnson and Mr. R. H. Atkinson at a meeting of the Institution of Chemical Engineers, in London, on Wednesday, with the president, Dr. William Cullen, in the chair.

Russia, Columbia, Abyssinia, produce platinum from alluvial deposits, whilst in Canada and South Africa platinum is obtained from primary deposits. Ural platinum, which is typical of alluvial platinum, has the following ranges of composition: Pt 73-86 per cent.; Fe 8-17 per cent.; Pd 0.3 to 1.8 per cent.; Rh, Ru, Os, Ir, 2.5 to 7.7 per cent. The native or crude platinum is recovered from the alluvial deposits by gravity concentration methods, which yield a concentrate sufficiently rich for refining. The concentrate is dissolved in hot concentrated aqua regia; ammonium chloride is added to the filtered solution to precipitate ammonium chloroplatinate, which is filtered off, washed, dried, and ignited to convert it into platinum sponge. If a purer metal is required the operations are repeated as often as may be necessary. The source of Canadian platinum is the well-known copper- and nickel-bearing deposits of the Sudbury district of Ontario. Palladium, in about the same amount as platinum, and subordinate amounts of other platinum metals are also present in these ores, besides silver and gold.

Although the amount of the platinum metals per ton of these deposits is very small, yet owing to the fact that large tonnages of ore, over 1,800,000 tons in 1934, are treated for the recovery of the main products, copper and nickel, very substantial amounts of the platinum metals are obtained as by-products. In the treatment of the Sudbury copper-nickel deposits, the platinum metals follow the nickel through the various operations; finally, when the nickel is separated in a pure form the platinum metals remain behind as a residue which can be concentrated sufficiently for refining by the aqua regia process.

The principal world source of palladium is the Sudbury copper-nickel ores. Rhodium, ruthenium, osmium and iridium accompany platinum in all the deposits which have been mentioned, and are at least partially recovered when the platinum

is refined. The principal source of osmium and iridium is the mineral osmiridium, which is now recovered as a by-product of gold mining operations on the Witwatersrand. The composition of this mineral is variable: osmium from 23 per cent. to 40 per cent., iridium from 21 per cent. to 35 per cent., ruthenium+rhodium from 9 per cent. to 15 per cent., and platinum from 5 per cent. to 15 per cent.

Operations at the Acton Refinery

The Acton refinery of the Mond Nickel Co. receives residues from the Clydach nickel refinery, which operates the nickel carbonyl process, besides concentrates from the electrolytic nickel refinery and a smaller amount of concentrates from the electrolytic copper refinery which treats the company's blister copper.



Fig. 1. Acton Refinery of the Mond Nickel Company. View of terraces in Wet Process Building.

The residues from Clydach refinery require further concentration before the platinum can be extracted economically with aqua regia. For this purpose they are smelted with litharge, fluxes, and charcoal in small tilting furnaces, with basic linings, to collect the precious metals and at the same time to slag off silica and base metals. The principal reaction during smelting is the reduction of lead oxide to metallic lead which acts as a collector of the precious metals. Another important reaction is between lead sulphate (which forms

approximately 50 per cent. of the Clydach residue) and soda ash according to the equation:—



The lead carbonate immediately decomposes into lead oxide and carbon dioxide. The sodium sulphate separates in the moulds as a top slag, which is removed and leached. Subsequent cupellation of the ingots in similar furnaces removes the excess of lead as litharge, which is used again in further smelting charges, and yields a precious metal alloy rich in silver, about four times richer than the Clydach residue.

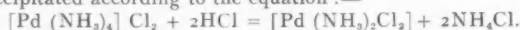
If lead alloys are cupelled to a finish, that is, until litharge ceases to form, there is a probability of producing a cupelled metal which is not readily attacked in the course of the subsequent refining operations, hence the reason for partial cupellation. This alloy is treated with boiling concentrated sulphuric acid, which removes most of the silver and about one-third of the palladium as sulphates. The residue contains the platinum, gold, and the rest of the palladium in a form particularly suitable for extraction with aqua regia, which is the next operation. From the solution of chlorides thus obtained, the gold is precipitated as brown gold by means of ferrous sulphate, and then the platinum as ammonium chloroplatinate by the addition of ammonium chloride, and lastly, the palladium is precipitated as palladosammine chloride.

One of these operations which calls for special comment is

the precipitation of palladosammine chloride. The palladium present as chloride is converted into soluble tetramminopalladous chloride by the addition of excess ammonia solution according to the equation:—



When excess of hydrochloric acid is added, the sparingly soluble yellow compound known as palladosammine chloride is precipitated according to the equation:—



The impure platinum salt is converted into metal by ignition, dissolved in aqua regia and reprecipitated as pure ammonium chloroplatinate, which, on ignition, yields pure platinum sponge. The impure palladosammine chloride is purified by dissolving in ammonia and reprecipitating with hydrochloric acid: the pure salt is converted into sponge by ignition. The silver and the gold are purified electrolytically, by the Moebius and Wohlwill processes, respectively, special attention being given to the recovery of small amounts of platinum metals.

Recovering Traces of Precious Metals

All liquors resulting from the processes are treated with zinc, or iron, and acid to recover traces of the precious metals. In practice, it is found to be more economical to smelt the final insolubles and reduction residues than to attempt to recover rhodium, ruthenium and iridium from them by wet processes. The lead ingots obtained by smelting are cupelled to remove excess lead and the resulting precious metal alloy is parted with nitric acid. The solution is treated in order to recover precious metals, especially palladium, platinum, and silver which dissolve during the operation. Most of the rhodium, ruthenium and iridium present initially in the lead alloy are concentrated in the insoluble from which they can be extracted and refined by chemical processes. Rhodium is extracted by fusing the concentrate with sodium bisulphate. Subsequently the rhodium is refined by a modification of the process described by Wichers, Gilchrist and Swanger.

The insoluble from the bisulphate fusion is given appropriate treatments to remove platinum, gold and lead sulphate as a result of which a concentrate of ruthenium and iridium is obtained. This concentrate is fused with caustic potash and potassium nitrate in spun iron bowls at a dull red heat which converts the ruthenium into soluble potassium ruthenate. The cakes are then dissolved in water; after settling the clear solution is decanted into glass flasks and treated with chlorine. This treatment converts the ruthenate into volatile ruthenium tetroxide which distils over on raising the temperature. The tetroxide is absorbed in dilute hydrochloric acid containing methyl alcohol. Evaporation of the contents of the absorption vessels gives an oxychloride, RuOCl_2 , which is reduced to metal by igniting in hydrogen.

Osmium Content

There appears to be very little osmium in the precious metal concentrates received from the nickel refineries. It amounts to less than 1 per cent. of the ruthenium content, and on account of the similarity in properties of these two metals it will be found as an impurity in the ruthenium unless it is eliminated, which can be easily done by heating the ruthenium oxychloride to dull redness in a current of air. The resulting osmium tetroxide is absorbed in an alcoholic caustic soda solution and the osmium recovered via osmyl tetrammine chloride, $[\text{OsO}_2(\text{NH}_3)] \text{Cl}_2$, which can be ignited to metal in an atmosphere of hydrogen. The caustic fusion, besides converting the ruthenium into potassium ruthenate, which is soluble in water, also converts the iridium into an oxidised form which, although insoluble in water, is said to be soluble in hydrochloric acid. Actually, aqua regia is used for dissolving the iridium.

The chloride solution thus obtained is evaporated and a crude ammonium chloridate obtained by adding ammonium chloride and oxidising with small amounts of nitric acid. The crude salt is separated from accompanying ammonium chloroplatinate by fractional crystallisation; the use of a mild re-

ducing agent facilitates the solution of the iridium salt. Recrystallisation is continued until the desired purity is achieved; the salt is then decomposed by heating in a gas-fired-muffle furnace. The partially oxidised metal is reduced by heating in hydrogen and is then further purified.

Refining of the richer concentrates from the nickel and copper refineries which contain more than 50 per cent. platinum metals and very little silver, commences with the treatment by aqua regia.

In precious metals refining, the order of operations depends on the ratio in which the precious metals are present. The order which is here described is followed because it has been found to be the most suitable for these by-product concentrates, although it is realised that other sequences of operations might be more suitable for other types of material. The average purities of the metals recovered from these concentrates are: platinum 99.93 per cent., palladium 99.94 per cent., iridium 99.7 per cent., rhodium 99.7 per cent., ruthenium 99.7 per cent., gold 99.97 per cent., and silver 99.97 per cent.

The high intrinsic value of the materials treated makes it imperative to reduce working losses to a minimum and to obtain the maximum yield as quickly and directly as possible. In practice, not more than 0.25 per cent. of the platinum metals contained in the concentrates is lost, while 1.25 per cent. is temporarily retained in furnace slags which are returned to the nickel refinery for retreatment. The remaining 98.5 per cent. is produced directly as refined metal. The losses occurring in the processes of extracting the nickel and copper are also very small, and it is estimated that 90 per cent. of the precious metals, probably excepting osmium, contained in the ore is ultimately recovered.

Wet Process for Platinum Refining

The chemical engineering problems in connection with the refining of platinum are of a specialised nature, with the result that experience in other fields is not always directly applicable. Moreover, the tradition of secrecy in the platinum industry up to the present has prevented refiners from pooling their experience except in a very general way. The state of affairs is in very marked contrast with what is known about the plant and processes for the refining of silver and gold.

The very nobility of the platinum metals necessitates the use of powerful acids and other reagents for refining them, a circumstance which rules out many of the standard materials for the construction of chemical plant; for instance, even stainless steel can rarely be used. The scale of operations is small, even the refining of platinum is frequently described as large scale laboratory work and the refining of other metals of the group is on a smaller scale still. Mechanical operations are reduced to a minimum, and where machines have to be used the simpler they are the better. The highly corrosive nature of most of the reagents, together with the importance of reducing losses of valuable metals to a minimum, are the main reasons for avoiding mechanical handling. The total handling loss in all refining operations is probably under 0.1 per cent.

Batch processes are also preferred to continuous processes because it is easier to check yields and make sure that precious metals are not going astray. For the same reason, namely, accounting for precious metals, all units of plant must be easily accessible for cleaning out on the completion of batches.

The wet processes are operated in a building specially designed for this work after five years' experience in temporary premises. The principal feature, shown in Fig. 1, is that the vessels are arranged on terraces. Successive steps of a process can be arranged in a line from the top of the building to the bottom, with gravity flow of the liquor from one vessel to the next. If a process requires more than five operations, the liquor from the fourth operation is elevated to one of the upper stages. In this way the number of times that the liquor has to be elevated is reduced to a minimum. Both acid eggs and centrifugal acid pumps have been used for elevating these liquors, and on past experience acid eggs are preferred.

The general layout of the building also facilitates super-

vision and control. The walls are built of white glazed bricks and the floors are constructed of chemical asphalt. Steam, water, vacuum, and compressed air are available on all the terraces. An overhead travelling crane enables any piece of plant to be replaced or moved to a different position. In addition to a complete system for the removal and treatment of all fumes generated in the operations, general ventilation is obtained by Robertson ventilators in the roof supplemented by fan ventilation where required.

Chemical stoneware is the most generally used material for the construction of plant for refining processes involving the use of acids, the two principal types of vessels being mixers or vats up to 100 gal. capacity, and vacuum filters up to 80 gal. capacity.

Treatment of Concentrates

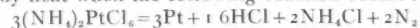
Aqua regia treatment of concentrates is normally conducted in steam-heated chemical stoneware vessels each of 140 litres capacity. A temperature of 90° C. is readily obtained, which is adequate for dissolving the finely divided platinum, palladium and gold contained in the residues. Working under these conditions, there is the further advantage that there is no risk of bumping when heavy insoluble matter settles to the bottom of the vessel. On the other hand, the conditions are quite different for dissolving mineral platinum, which is best done in gas-heated vitreosil bottles of 70 litres capacity, using concentrated aqua regia at or near the boiling

iron, pyrex glass and ceramic dishes are used. Residues, which sinter during calcining, or cake during drying, may have to be converted into powder for subsequent operations. For this purpose there are four 8 in. and on 14 in. disc pulverisers. Care is taken to collect and recover all dust produced during pulverising by means of a fan and bag system.

Removal of Acid Fumes

The fumes given off during reactions include sulphur dioxide, sulphuric acid, chlorine, hydrochloric acid, oxides of nitrogen and nitrosyl chloride. Although stoneware fans can handle mixed acid gases such as these, it is more satisfactory to use an ejector in which the gases do not pass through the fan. In the latter system a fan delivers a jet of air at high velocity into a specially designed nozzle, which has the effect of creating sufficient suction to draw the fumes away from the reaction vessels. The acid fumes are neutralised in chemical stoneware scrubber towers by a sodium carbonate solution which is kept in circulation by centrifugal pumps.

Ammonium chloroplatinate can be converted into metallic platinum by reducing the moist salt with zinc dust, but the resulting platinum is contaminated by any impurities in the zinc and requires further treatment, including ignition, before it is fit for sale. Consequently it is preferable to decompose the salt by heat when the following reaction occurs:—



Although it is an easy matter to ignite a few grams of

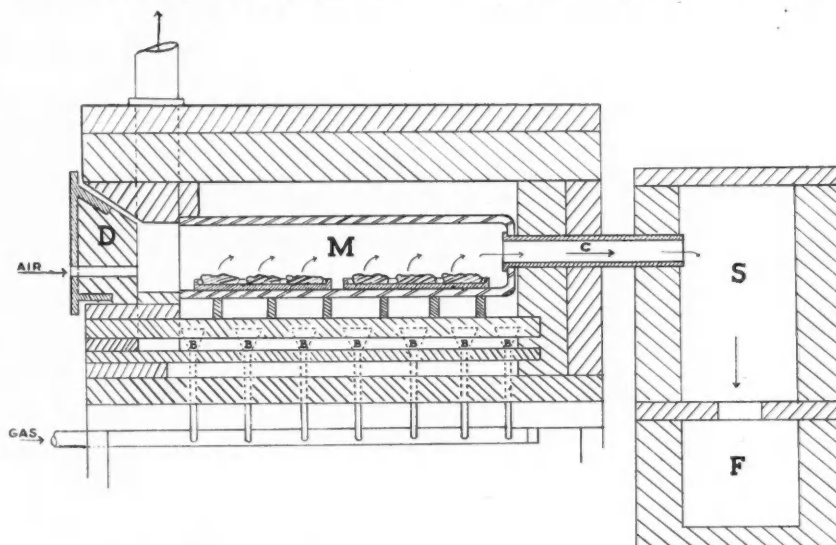


Fig. 2. Furnace for decomposing Platinum and Palladium Salts.

M—Muffle. C—Cronite Tube. S—Sublimate Box. F—Flue. D—Door B—Burner.

point. Evaporation of nitric acid solutions is done in similar vitreosil bottles equipped with condensers suitable for the distillation of mineral acids. Nitric acid treatment is carried out in gas-heated 20-litre basins made of vitreosil, which are also used for sodium bisulphate fusions. Sulphuric acid treatment is done in pans made of fine-grained grey cast iron, each of 25 litres capacity, and heated by gas.

Wooden tanks up to 300 gals. capacity, lined with soft rubber, are satisfactory for some of the operations, for instance, reactions in which sufficient free hydrochloric acid is present to make lead-lined vessels unsuitable. Acid-resisting hose is used to convey acid liquors and to make connections for removing fumes from reaction vessels. Steel vessels lined with hard rubber are preferred to chemical stoneware vessels for operations involving the use of hydrochloric acid in which the heat of reaction causes a rapid rise of temperature. Porcelain plant is used for small-scale purification work.

The drying of various intermediates and products, most of which are slightly acid, is done in gas-heated drying ovens, some of which are thermostatically controlled. Enamelled

either of these salts under laboratory conditions, the decomposition of 50 kilos. a day presents an engineering problem. The best solution of the problem was not obtained at the first attempt, but the comparatively simple arrangement of plant shown in Fig. 2, which has now been in use for several years, fulfils the essential requirements of (i) high purity of product, (ii) trouble-free operation, (iii) low cost of operation and maintenance, and (iv) efficient collection, removal, and neutralisation of the fume.

The dry salt is placed in vitreosil trays which are slowly heated in muffle furnaces fired by gas. Particular care must be taken whilst heating the material from 310-370° C., after which the temperature is raised to 900° C. to complete the removal of volatile matter. The salt is wrapped in filter paper to reduce losses during decomposition. The fumes evolved from the decomposing salt are drawn away through C, a cronite tube, an alloy containing nickel, chromium and iron, into a sublimation box S, where most of the sublimate settles, and thence into a flue F which leads to a central scrubbing plant where the hydrochloric acid is neutralised. As the fumes

are particularly unpleasant, it is important that the ammonium chloride, sublimate, should not be allowed to settle out prematurely and block the fume pipe. When decomposing palladosammine chloride it is advisable to place a small gas burner under the cronite pipe as the fumes contain much more ammonium chloride than the fumes from the platinum salt, and there is more likely to be blockage of pipes and flues.

Uses of Platinum Metals

Platinum condensers are used in the manufacture of hydrofluoric acid. Apart from this special case, plant made of platinum is no longer used industrially for concentrating or distilling acids, but there are very considerable amounts of platinum in use in acid works. For instance, there were between 60,000 and 80,000 ozs. of platinum retorts at the Modderfontein Explosives Factory in South Africa, a great deal of which was in use up to about the year 1906; this platinum had been bought at a very low price, so when it was sold a very considerable profit was realised by the company.

Coincident with the decrease in the use of platinum for concentrating sulphuric acid, there was an increased demand for it in the catalytic production of the same acid. Under the stimulus of competition from vanadium pentoxide catalysts

the performance of platinum catalysts has been improved, and the amount of platinum now required in United States plants per ton day of 100 per cent. sulphuric acid is from 5.5 to 7 oz. troy for platinised asbestos or platinised magnesium sulphate compared with 13 to 16 oz. during the war, whilst it is only 1.5 to 2.1 oz. for platinised silica gel, a new type of catalyst first used on the factory scale in 1926. It is claimed that the latter catalyst is immune to arsenic poisoning.

In the production of nitric acid by the catalytic oxidation of ammonia, the ammonia oxidation unit employs a catalyst gauze of platinum, or preferably a platinum-rhodium alloy, wire 0.003 in. in diam., with 80 meshes per lineal in. This gauze, of four or more layers, is in the form of a flat pad or a cylinder through which the mixture of ammonia and air passes; the area of the gauze depends on the type of converter. The gauze may attain a temperature of 900° C. in service, but platinum alloys withstand high temperatures so well that a single catalyst unit will produce upwards of 4,000,000 lb. of nitric acid before requiring attention.

The use of platinum spinnerets in the viscose process for the manufacture of rayon or artificial silk depends on its resistance to chemical corrosion combined with good machining properties.

Lactic Acid Compounds

Some Recent American Developments

MUCH research work on the production of lactic acid and its salts from lactose has been carried out in recent years by the American dairy industry and several improved processes have now been announced. In that developed in the research laboratories of the National Dairy Products Corporation, of Baltimore, the raw material is milk that has been soured to the isoelectric point (pH 4.6 to 5.0). Lactic fermentation is found to proceed more satisfactorily after separation of most of the proteins, which is effected by heating the soured milk (with agitation) to a temperature of about 140°F., and then allowing to cool slowly, a treatment that incidentally pasteurises the proteins. After several hours, separation of the proteins sludge is substantially complete and the clear layer of whey can be siphoned off.

In the nearly protein-free whey thus isolated, lactic acid is developed with the aid of a suitable lactic organism over a period of 10 to 24 hours, in the course of which calcium oxide or other suitable lime compound is added occasionally to combine with the free acid as formed, a temperature of 100°F. being maintained during this operation. Finally, the liquor is made neutral with the lime compound and heated to 180 to 220° F. On cooling, a white sludge containing a further proportion of the nitrogenous and other impurities settles out after about 2 hours, whilst the calcium lactate remains in solution and is siphoned off, condensed in a vacuum pan and crystallised.

Purification of the crystals is effected by washing in a centrifuge, dissolving in water, raising the solution to a temperature of 140 to 160°F. and adjusting the pH to 10 to 12 by the addition of lime. On standing for 2 to 3 hours the remainder of the impurities settle out as sludge. The purified supernatant liquor is siphoned off and neutralised with a small quantity of lactic acid. A still higher degree of purity can be attained by clarifying with vegetable charcoal and filtering hot.

A slightly modified process disclosed by the Sealtest System Laboratories, of Baltimore, commences from whey that has been prepared by any usual method. This is first neutralised with calcium hydroxide until a pH of 6.5 to 7.5 is reached, when the liquor is fermented to lactic acid (with addition of a lactic organism if necessary), the temperature being raised to 110° F. to accelerate fermentation of the lactose. As in the foregoing process, lime is added from time to time to com-

bine with the lactic acid formed and also to maintain the optimum hydrogen ion concentration (which ranges from 5.5 to 7.0 according to the type of organism used). At the conclusion of fermentation proteins and other undesired substances are coagulated by raising the temperature to 180 to 250° F., and the supernatant lactic solution is removed by filtration.

To obtain a water-white solution of calcium lactate (which, it is claimed, has not previously been possible) the crude filtrate is subjected to combined treatment with an adsorbent (charcoal or fullers' earth) and calcium oxide or hydroxide. This treatment is stated to result in rapid and complete separation of any undesired substances still present in the filtrate. The liquor treated in this manner is filter-pressed or centrifuged, the excess alkalinity neutralised with lactic acid, and the crystals formed after concentration in a vacuum pan are centrifuged and dried.

While the same principle can be applied to the production of sodium lactate and other salts, it is more convenient to use the pure calcium lactate as an intermediate. To prepare the sodium salt, treatment with sodium sulphate forms insoluble calcium sulphate and the highly soluble sodium lactate. The solution of the latter is filter-pressed and worked up in the same manner as the calcium lactate. The final product is a non-crystallising and very pure syrup, resembling glycerine.

Similarly, the calcium lactate can be used as an intermediate for the manufacture of the acid itself, the pure crystalline salt being dissolved in hot water and acidified with concentrated or slightly diluted sulphuric acid. After filtering through a press, a dark-coloured solution of the acid is obtained owing to the presence of heavy metal impurities. It has been found that these impurities can be eliminated by treatment with potassium ferrocyanide or like agent and charcoal.

THE Society of Chemical Industry in Basle, increased its net profits for 1936 to 4.61 million francs (compared with 3.2 million) and the dividend is raised to 20 per cent. (15 per cent. previously). According to the annual report there was greater activity at their Swiss and foreign factories resulting in an increased turnover particularly in the dyestuff and pharmaceutical sections.

How to Deal with Industrial Risks

Deputy Chief Inspector of Factories gives Some Useful Hints

COLONEL A. W. GARRETT, deputy chief inspector of factories, read a paper on "Some New Industrial Risks and How to Deal with Them" at the recent industrial safety conference held at Oxford under the auspices of the Natural "Safety First" Association, in which he touched on several points affecting the chemical industry.

It is essential, he said, that before a new machine is brought into use or a new process introduced, the risk of accident on the machine or the effect of the new process on the health of the operative should be fully considered.

Mechanical risks are easier to foresee than the ill effects due to new chemical substances, gases, dusts, or vapours, which may be injurious to health and which may have only a very slow effect. In the case of new machinery one can sit down with a drawing-board and design guards for dangerous parts, and this can and should be done before the machinery is brought into use. In other words let your drawing office take a real interest in your safety campaign and do not wait till an accident has made you think. In the same way chemists and medical men should consider and design safe methods of working when a new substance is introduced—even up to the point of experiment with animals, if necessary.

In both these cases the best results will only be obtained when the machine or process is installed if the dangers are fully explained to the workpeople and they are quietly but definitely shown the necessary precautions that must be taken.

Electrical Risks

A new process has been introduced for forming an insulating skin on aluminium, for use in the electrical industry. It is an anodic oxidation process and the plant resembles an electro-plating plant but the voltage used is as high as 500 which very much exceeds the 6 volts used in plating. There is a risk of a serious electric shock in carrying out the wiring of articles in this process and the only safe method is to ensure that the conductors are accessible only when the current is off. This is done by providing a complete cover for the bath and arranging an interlock between the cover and the handle of the switch.

Every year more cases crop up in which electric apparatus is required to work in an atmosphere containing inflammable vapours or gases with the consequent risk of explosion or fire. For example, volatile solvents are being manufactured on a big scale, in other places the air contains such impurities as carbon bisulphide vapour, or coke oven gas. Difficulty arises because the so-called flameproof apparatus is not guaranteed safe in all these cases, owing to the great variety of conditions. It is now somewhat easier to deal with coal mines because the risks are more or less of the same nature everywhere, and it has been possible to build up sound practice based on long experience. But in factories there is a much greater variety of conditions and in many cases short experience. It is not practicable to carry out tests of apparatus for every kind of gas or vapour.

Research, however, has been arranged by the Electrical Research Association, and tests are to be carried out at the Safety in Mines Research Station. It is hoped as a result to classify the various inflammable gases and vapours into about four groups.

Inflammable Alloys

The demand for machine parts of very light weight for aeroplane construction and motor car work has led to the increased use of alloys of magnesium. The parts are machined just as other metal articles are machined. While substantial pieces of the metal cannot be easily ignited and will not continue to burn, the swarf from the machines—that is all the turnings, drilling and borings—is highly inflammable. It burns with an intense white light—so brilliant that it is very

alarming to anyone standing near. The fire may only be made worse if ordinary methods of fire extinguishing are used. It is very important that water should not be applied to the burning mass as the burning progresses more rapidly owing to the generation of hydrogen.

A considerable amount of investigation has taken place to discover the best method of dealing with such a fire and one of the best methods which has been used in practice consists in smothering the fire with a mixture of short natural asbestos fibre with 20 per cent. of graphite. This should be kept in metal containers with lids and emptied into the fire. It can be used over and over again. It is much more efficient than sand as a means of smothering the fire and has the added advantage of not damaging the machine tools over which it might be poured.

There are some very simple precautions which can be taken to reduce the risk of a fire starting. Cutting tools should be kept very sharp to reduce friction. The floor and the machines should be kept dry and turnings should not be allowed to accumulate—they should be collected frequently and placed in metal bins with lids. High speed automatic jobs have been cooled with compressed air, but this has been found to blow dust about and this is undesirable. No grinding should be carried out near the machines and each machine should be furnished with a supply of the fire extinguishing mixture. If the parts have to be ground the dust should not be exhausted into a common system of ducting. Each wheel should have a self-contained exhaust plant.

Celluloid and Cellulose Solutions

The risk of fire where celluloid is used has always been recognised. Workrooms are provided with adequate exits and fire extinguishing appliances, but the risk of personal injury in the place where the celluloid is stored has not always been appreciated. It has generally been considered sufficient to keep the celluloid in a store built of fire-resisting materials in a place apart from the workrooms. Thus the risk of any source of ignition getting into the storeroom was small and only occasional short visits to the store were necessary; this fact reduced the personal risk to a very small one. A fire in which two boys were burned to death has shown the importance of a safe lay-out and safe exits in the stores. It is very desirable that the storerooms should be small chambers in which the racks, etc., can be so arranged that the available floor space in which a person can stand is limited to a few square feet just inside the door. This arrangement makes it almost impossible for a person to be cut off by a fire in the storeroom itself. In storerooms of larger dimensions there should be at least two exits and the stock should be arranged intelligently so that the exits are always readily accessible.

Cellulose nitrate should not be kept in the same store as inflammable liquids, because in the event of fire, burning cellulose nitrate would be liable to cause explosions of containers of inflammable liquids with serious risks to persons and property in the vicinity.

Risk of Fire

Experience has shown that in using cellulose solutions the risk of explosion from vapour is very small if modern ventilation plant is used. There is, however, a considerable risk of fire from the dried deposits which form on surfaces near a point where spraying is carried on or in the ventilation ducts used in connection with the process. There have been a number of fires from this cause although there is, fortunately, no record of any personal injury having been caused.

Any scheme which helps to prevent the formation of deposits or which facilitates their removal from any surface must be recognised as a valuable safety measure. One scheme has been brought from Switzerland in which a filter is intro-

duced between the spray gun and the ventilating duct. This has proved of great value in keeping the interior of the ducts free from deposits.

Advances in chemical knowledge due to the great amount of research carried on have had the effect of making many new organic compounds available for various purposes in industry. Where any new material is introduced it is of the utmost importance that its effect upon the health and safety of the workers should be considered before it is used in an industrial process. Here, perhaps more than anywhere else should the motto of "Safety First" be applied literally.

Inhalation of Toxic Vapours

Safety should be considered not merely when a process has been decided upon, but before any details of the proposed process are worked out. The need for this was demonstrated very forcibly two or three years ago when a number of men died in rapid succession from poisoning due to the inhalation of a vapour of which the toxic properties had not been appreciated. The process was one in which artificial silk threads had to pass through a solution of an organic compound in a covered trough. This was carried on without any noticeable ill effects for some months. Then the troughs were provided with better covers to avoid loss of vapour and the process was speeded up. The effect of this appears to have been that when the men employed on the process raised inspection covers which they had to do from time to time, they inhaled a more concentrated mixture of the vapour and air than formerly. It was some time after the fatalities referred to had occurred that the cause was definitely established. The process has now been made safe by a suitable ventilation system, and safer still by the substitution of another product for the dangerous one.

This very serious succession of accidents forces one to consider whether the same thing might not happen again in any other new processes. And one is forced to answer "Why not if a substance is used before its physiological properties are known." Safety can only be incurred by making the necessary tests before the substance is used. In particular all new substances that are in any way related to substances of known toxicity should be carefully tested before being taken into use.

If the material is understood, precautions can be taken and risks avoided. An example of this is the blending of lead tetraethyl with petrol. Here the danger was fully recognised and thorough protection was provided by direct complete enclosure and by the provision of special clothing and breathing apparatus.

Testing of Gases

The risk of poisoning or suffocation by breathing in air containing injurious gases, vapours or fumes is one which is common to many industries. Attempts have been made to get rid of the danger, but in spite of this the accident has happened, and safety appears to depend upon an exact knowledge of the condition of the atmosphere in any tank or chamber before a person enters it. It is not always possible to get rid of every trace of a dangerous gas, but it is essential that the percentage in the air should be reduced to a safe limit before any person enters. It may be a simple matter in some works to make accurate tests for the estimation of gas percentages, but this certainly does not apply everywhere. There is then clearly a demand for some simple and convenient apparatus to make such tests rapidly on the spot. Such an apparatus is now available in the form of the "Porton Pump" an apparatus due to Mr. L. C. McNair, H.M. Engineering Inspector of Factories. It consists of a small portable air pump which takes in an exact quantity of air at each stroke. The number of strokes is given automatically by a counter so that any desired volume of air can be poured through the pump. The air is drawn through a filter paper saturated with a reagent and dried, fixed in a small metal box on the intake end of the pump. The reagent used depends upon the gas for which a test is being made and gives a colour to the test paper when the gas passes through it. The

quantitative estimation is made by comparing the test paper with a standard paper colorimetrically. Standard papers have now been produced for sulphuretted hydrogen (H_2S) and others will be produced later.

Electrostatic Deposition of Dust

In many trades dust is collected in ventilation systems and the problem of dealing with the dust-laden air is always a serious one. While heavy particles of dust may be separated by ordinary settlement there is often a considerable quantity of fine dust carried away and almost as often there is a complaint from neighbours of dust exhausted from works settling on their premises. The separation of fine dust from air by electrostatic deposition can no longer be described as a new method as it has been well established for a considerable number of years. The extension of its use and application is, however, worthy of mention. The method is very effective and its advantages have been particularly noticeable in the surroundings of cement works where it has been applied. Another very useful application is in the cleaning of flue gases from large power station chimneys. There is a great field for the use of this method if a cheap small unit can be evolved.

One essential of all methods of promoting health and safety is co-operation. There must be co-operation between all parties concerned if improved conditions are to be secured. The Factory Department recognises this and of recent years numerous conferences have been held between representatives of industry and of the Department to discuss new risks and new safeguards. In most cases agreements have been arrived at and the effect has been to obtain a general and uniform adoption of the most up-to-date safety methods. These agreements are all very technical, but their close study is recommended to those interested in the particular industry concerned; for example, the Woollen and Worsted Agreement of 1936 appeals to Yorkshire, and Mr. Lauder, superintending inspector at Leeds, will gladly give particulars. The same applies to the Cotton Agreements for Lancashire and the Tin Plate Agreements for South Wales. Agreements have either been signed or are nearing that stage in the case of flour milling, paper making, gasholders, blast furnaces, pulverised fuel, rubber machinery and film stripping and other trades. This co-operation can be extended even down to the individual machine if the machine makers, the users and the factory inspectors are prepared to pool their ideas. If this spirit of co-operation is maintained the future of the safety movement is assured and factories will be better places to work in than ever before.

Safety and the Law

Machinery Greased Whilst in Motion

THE May issue of the National Safety First Association's "Industrial Safety Bulletin" reports that within three days two men in the same factory were injured through greasing machinery while it was in motion. In the first case the greaser was standing on a beam only three inches wide and over thirty feet above the floor. The beam was slippery, and on each side of it unfenced machinery was running. He moved his foot slightly and a skid-bar came round and fractured one of his toes. Fortunately he was able to preserve his balance and so saved himself from serious accident, but he was unable to return to work for six weeks.

Two days later the man who was doing the work of the injured greaser had to stand on a platform eighteen inches wide and slippery with wet clay. As he leaned over to grease a bearing his foot slipped down between a pulley and the platform. His clothing was torn off and he was only saved from being dragged into the machinery by the fact that the manager was standing near and was able to pull him back.

The firm stated that in both cases the employees had been disobeying orders in greasing moving machinery. The manager mentioned in the second case was no longer in the firm's employ. A fine of £40 was imposed.

The Voluntary Pension Scheme

Provisions of the New Bill

LARGE numbers of workers in the chemical and allied industries at present outside the limits of compulsory insurance will be able to make provision for old age under the new Widows, Orphans and Old Age Pensions (Voluntary Contributors) Bill provided they can fulfil the income, age and residential conditions (ten years' residence in Great Britain) laid down in the Bill.

The income can be anything up to £400 a year for a man (up to £200 unearned) and up to £250 (up to £125 unearned) a year for a woman. A point to note is that the income is taken as that when application is made for insurance; once admitted the insurance continues no matter what the income may subsequently become. These insured persons will be termed "special voluntary contributors"; other voluntary contributors, transferees from compulsory insurance, are called "ordinary voluntary contributors" and these can insure for either pensions or health insurance or both.

Initial Entrants

Until January 3, 1939, an application by any person who was under 55 years at the commencement of the Act (commencing date January 3, 1938) will be accepted and the contributions paid by these entrants called "initial entrants" will be less than will apply afterwards, being 1s. 3d. weekly for men, 6d. weekly for women, irrespective of age at entry. Persons who are nearly at the age limit (born 1883) should note that application can be made before the actual commencing date, and then the insurance will be dated from the first day, January 3, 1938; persons who are under 55 at this date but who attain the age of 55 years in 1938 if they apply after the date of their 55th birthday will be accepted and the insurance will be dated to commence on the day they attained the age of 55. This is important as at least ten years' insurance must be proved before the age of 65 for an Old Age Pension to be payable.

After the first year no person will be admitted into voluntary insurance as a special voluntary contributor unless he is under the age of 40 at date of entry. Contributions will be different from those for initial entrants, being based upon age at date of entry; for men these rates range from 1s. 3d. weekly for persons entering when under the age of 21 years, rising on a sliding scale to 2s. 11d. weekly, when entry is made at age of 39 years. For women, the contributions range from 6d. weekly if under 25 years at entry, up to 11d. when entry is made at 39 years.

Rates of Pension

Insurance must have been for 104 weeks (with 104 contributions paid) before a widow's or orphan's pension is payable. For an old age pension at least ten years' insurance must be registered before the age of 65 is attained and 260 contributions must have been paid before that date also. But even if these conditions are fulfilled it does not follow that the full pensions (*e.g.*, widows or old age 10s.) will be payable; with only 260 contributions over ten years the pension would be 5s. The rate of pension is determined by the average of contributions reckoned according to contribution total and the number of years which have elapsed from entry into insurance to the event (death or age of 65) for which a pension is required. For full pensions an average of 50 a year must be registered; for averages of 45, 40, 35, 30 and 26 contributions, the rates of widows' or old age pensions would be 9s., 8s., 7s., 6s. and 5s. respectively.

At least 26 contributions a year must be registered or right to voluntary insurance ceases, but the insurance is not terminated until the end of the contribution year following that in which the total was under 26; but if the number for that year is made up to 26 during the following contribution year men-

tioned, and also for that year, payment of 26 contributions is made, the insurance is continued. If a person ceases insurance he is not necessarily disqualified from receiving a pension altogether, as provision is made for certain pensions to be paid, provided the person has been insured for a period and has registered at least 26 contributions a year for five consecutive years, the pension roughly being decided by the nearness of the event (death or age of 65) to the cessation of insurance, the person's contribution history, and the contribution totals throughout the insurance.

Any person who ceases insurable employment can enter voluntary insurance without the income, age or residential tests, provided that he has been compulsorily employed for at least 104 weeks. Such a person—an ordinary voluntary contributor—can insure either for pensions or for health insurance or both (formerly only the combined scheme could be adopted); if he adopts both schemes, two cards are required and two contributions, these rates being for men 11d. for pensions, 9d. for health insurance; for women, 5½d. for pensions, 8½d. for health insurance.

Voluntary contributors who are insured on January 3, 1938, can either continue under the old scheme (the new Act having no effect in this case) meaning being insured for both pensions and health insurance by one card and one stamp (men 1s. 8d., women 1s. 2d.) or enter as a voluntary contributor as in the preceding paragraphs either for pensions or for health insurance, or for both, in which event the insurances must nevertheless be separate, and two cards will be required (rates for pensions: men 11d., women 5½d.; for health insurance: men 9d., women 8½d.). If a person takes no action he will automatically be considered as wishing to enter the new pensions scheme and continue in health insurance separately. If he wishes to continue as now, he must notify the authorities; a period will be allowed for this purpose and details of this procedure will be published.

Seaham Coal-Oil Plant

Petrol Extraction to be Discontinued

MR. HARRY LANE, of Lane, Fox and Co., Ltd., builders and contractors, Norton and Sunderland, has purchased the works at Seaham of Coal and Allied Industries, Ltd., London, which were recently offered for sale by the receiver appointed by the debenture holders. The works are to be adapted for the making of semi-coke by one of the proved and established low-temperature processes. In time it is hoped to secure an output of 500 tons daily. The works are expected to be in production again by the end of the year.

It is not intended, it is stated officially, to continue the extraction of petrol from coal. It is understood that the coal required will be taken from Vane Tempest Colliery belonging to Londonderry Collieries, Ltd. Mr. M. Dillon, managing director of the colliery company, in an interview, said the works would absorb a large number of men.

The plant is built on land leased by Londonderry Collieries, Ltd. They were started early in 1935 and cover a site of 59 acres. In the first place it was proposed to extract petrol from coal and make other chemical products.

In December, 1935, a fire took place and it was announced that the company intended carrying out certain modifications and extensions costing £150,000, and it was estimated that by 1938 the plant would have been able to earn an annual profit of £66,000. Mr. Harry Lane, the new owner, is also managing director of Heenan, Baddow and Sturley, Ltd., who are engaged as structural steel engineers at the Newton Heath Ironworks, Manchester, and as lock manufacturers at Willenhall, Staffordshire.

The Fuel Supplies of Great Britain

Oil Requirements Must be Imported

PROFESSOR A. W. NASH, of Birmingham University, presented a paper on "The Fuel Supplies of Great Britain" at the Royal Society of Arts on May 5, in the course of which he said that the extent to which oil had encroached directly on the coal markets of this country was comparatively small. There was, however, another aspect of the situation. Was it not possible that the importation of petroleum into this country, which had caused the introduction of new industries, might indirectly have saved our coal-mining industry from an even worse fate than it had already experienced?

Petrol Creates Increased Demands for Coal

The industries which had thrived on the use of oil as a fuel for the internal-combustion engine had made, and continued to make, large demands on coal in the process of manufacture. Every motor car, motor coach, omnibus and motor lorry on the roads represented a substantial use of coal in the construction of many of the parts of which it was composed. Similarly, the aeroplane and the wide development of its manufacture in recent years had provided another outlet for the use of coal. In confirmation of this, he quoted the following extract from a lecture delivered by Sir Henry Tizard, Rector of the Imperial College of Science, at the Centenary Meeting of the British Association for the Advancement of Science:—"Petrol has not replaced coal—on the contrary, it has created a demand for it. The average life of a private motor car is estimated at seven years, during which time it consumes some seven tons of petrol. But how much coal is consumed in the manufacture and repair of cars? It is difficult to get an accurate estimate of this, but it must certainly be of the same order as the amount of petrol which the car uses; *i.e.*, seven tons per car on the average. From what figures I have been able to obtain I think it is fair to say that every ton of petrol imported into this country creates a demand for at least one ton of coal—a demand which practically did not exist thirty years ago."

Over 50,000 tons of imported food reached our shores daily as compared with 28,000 tons of oil; but whereas with food-stuff practically the whole of the money expended on both the goods and their transport might be sent abroad, the same remark did not apply to imported oil. Large quantities of the materials used in our oilfields and refineries abroad were made in this country. There were over 200 engineering works in Great Britain which manufactured equipment for the various branches of the oil industry, while the benefit which had been conferred on the shipbuilding industry of this country by the construction of tank steamers during the period of depression must have been shared to some extent by the coal-mining industry. Last year the three principal groups marketing oil in Great Britain, alone spent £10,000,000 in the United Kingdom on stores and equipment, and the total expenditure on this account by all the oil companies was considerably more and probably in the neighbourhood of £15,000,000. In addition to this, from January, 1935, to August, 1936, forty-six oil tankers were ordered or launched in this country on behalf of these three groups at a cost of £6,730,000 giving employment to over 31,000 men, including some 3,000 colliers.

Employment in the Oil Industry

It should be further noted that in Great Britain alone there were some 30,000 persons employed directly by the oil industry, apart from large numbers of Britishers employed on the oilfields abroad and in manning our tank vessels. Incidentally it was worth noting that the British Empire owned the largest tanker fleet in the world. Without taking into consideration the £47,750,000 which the Government received

from import duty on oil in the last financial year (this had nothing to do with the vehicle tax of £32,500,000), it would be seen that, far from the foreigner being the sole beneficiary, Great Britain derived a very large direct and indirect income from her investments in the oil industry.

The consumption of petroleum products in this country was now about 10 million tons annually, of which nearly one-half was petrol, and over one-third comprised lubricating oils, Diesel oils and fuel oils. The import of petrol, lubricating oils and Diesel oils had clearly not displaced any fuel indigenous to this country, and the comparatively small increase in the consumption of fuel oil had been shown to be largely due to uses for which coal was not so well suited.

On the other hand, the use of liquid fuels had given birth to a vast group of new British industries the chief of which was the manufacture of mechanical road vehicles, which directly employed a quarter of a million persons, apart from approximately one million persons engaged in the operation and repairs, etc., of road vehicles, and indirectly through its use of steel, etc., many thousands of employees in the heavy and coal industries. To a more limited extent the same applied to aircraft manufacture.

Referring to the production of oil from coal, Professor Nash said they might dismiss the low temperature carbonisation of coal at once because such an industry could never become a source of supply of liquid fuel of any magnitude since the primary product was semi-coke, and the oils and tars obtained were by-products of comparatively small yield. They had seen within recent years an extraordinary advance in the mechanisation of our defence forces, and in any scheme of national defence the question of oil supplies must, therefore, rank in importance with that of our food supplies.

Inadequacy of Home Production

The home production of motor spirit from indigenous materials amounted to between 6 and 7 per cent. of our total requirements, on a peace footing, at the present time, and the home production of fuel oil was so small as to be negligible. No responsible person would, therefore, suggest that home production could possibly supply any substantial part of our liquid fuel requirements, irrespective of cost, for any lengthy period. Such a project would require a colossal capital expenditure, would result in a most serious loss of revenue to the country, and could only be realised after a period of many years.

A hydrogenation plant capable of producing 150,000 tons (our present annual consumption was about 4½ million tons) of petrol a year from coal and tar required a capital expenditure of roughly £5,500,000, and involved under present conditions a loss of £1,500,000 to the revenue per annum, since the petrol was produced at a cost which could not bear an excise duty without involving a very substantial rise in the price of motor fuel. To erect hydrogenation plants capable of producing our entire domestic requirements of petrol from coal in peace time would mean an expenditure of probably £140,000,000 and a loss to the tax revenue of practically £45,000,000 per annum. This loss of revenue would, of course, have to be made up by taxation in other directions.

As this type of plant could only be erected in highly industrialised areas, it would be particularly liable to damage from sabotage, or by enemy action from the air, since concealment would be out of the question. If, therefore, this country was to establish adequate reserves of oil, it was clear they must mainly come from imported supplies. The storage of oil in steel tanks or concrete reservoirs whether above or below ground, was a simple and not a costly matter. These tanks or reservoirs could be distributed in the less congested areas, and the labour cost for supervision would be small.

Chemical Notes from Foreign Sources

Belgium

A NEW PROCESS OF RUBBER REGENERATION will be operated at a factory in Mecheln employing 70 workers.

Lithuania

AN INSULIN DEPARTMENT HAS BEEN ORGANISED at the Maistas Meat Factory.

Hungary

SODIUM BENZOLE SULPHOCHLORAMIDE is now being manufactured by the Chinoin A.G. of Ujpest and is distributed under the designations of chlorogen and neomagnol tablets.

Japan

TUNGSTEN PRODUCTION IN KOREA is to be increased by the Kobayashi concern and by the Japanese Mining Co. with a view to developing an export trade.

Poland

THE MANUFACTURE OF SYNTHETIC TANNING MATERIALS is to be undertaken by the British Hungarian Chemical Industry Company.

Russia

PRODUCTION OF AGAR-AGAR is being developed on the Karelian coast, 183 tons of raw material having been collected in the past year.

Switzerland

ESTABLISHMENT OF A BEET SUGAR FACTORY in the canton of Ticino is under consideration. Home-grown beet would be worked up if the plan came to fruition, and the factory would be the second one to be erected in the country.

Holland

THE N. V. NEDERLANDSCHE GIST-EN SPIRITUSFABRIEK, a leading firm of yeast manufacturers, achieved a net profit of 2.29 million florins in 1936 (unchanged), and once again is distributing a dividend of 6 per cent. on the preference shares and 15 per cent. on the ordinary shares.

Hungary

TITANIUM COMPOUNDS ARE SAID TO BE EXTRACTABLE from bauxite residues by a process patented by I. Mackray. Treatment with hydrogen sulphide converts the iron compounds into the sulphide which does not interfere with subsequent chlorination when the titanium compounds are separated as titanium chloride. In addition to chlorine itself, sulphur chloride or carbon tetrachloride are stated to be applicable as chlorinating agents.

France

DEPOSITS OF NATURAL STRONTIUM SULPHATE are to be exploited at Condorcet, in the department of Nyons.

BY-PRODUCT OUTPUT OF THE COAL-MINING INDUSTRY has expanded considerably during the last few years. The Liévin Colliery, for instance, has doubled its production in the past three years, and its annual production figures are now given as 7,540 tons tar, 951 hectolitres motor benzole, and 110 hectolitres toluole.

Poland

PRODUCTION OF BUTYL ALCOHOL, acetaldehyde and crotonaldehyde has been commenced by the Kutno Co. of Warsaw.

CASEIN ARTIFICIAL HORN is now being made by the Polchem, Polish-Belgian Chemical Works, at Thorn. The new department commenced operations on April 28.

INTENSIVE PRODUCTION OF MORPHINE AND CODEINE from native poppies by the Polish Roche concern has enabled this firm to meet the entire home demand and leave a surplus for export to Northern Europe.

Czechoslovakia

THE REMED COMPANY (pharmaceutical chemicals) closed the 1936 trading year with a reduced net profit of 175,000 kronen (against 204,000) and is distributing a dividend of 4.75 per cent. (5 per cent. previously).

Holidays with Pay

Tribute to Chemical Industry

THE lead given by the chemical industry generally to the movement for granting holidays with pay to all workers was referred to by the Ministry of Labour at the inquiry which is now being conducted by the special committee set up by Mr. Ernest Brown (Minister of Labour), into the desirability of some statutory enactment on the subject.

Mr. F. W. Leggett, Principal Assistant Secretary, who submitted the Ministry's evidence, pointed out that the practice of granting holidays with pay to the usual body of wage-earners—except on the railways and in the public utility services—was practically unknown before the war, but that immediately after hostilities, certain industries took the lead and made general and district collective agreements between employers and workpeople throughout those industries to pay for holidays. The more important general agreements covered heavy chemical manufacture, drug and fine chemical manufacture, flour milling, match manufacture, paint, colour and varnish manufacture, gasworks, etc. The movement continued to spread until 1925, since which time there had been a relatively small increase in the number of new agreements. The later district agreements included the explosives industry, which came in in late 1925, and the chemical workers of London, who were the subject of a separate agreement. It was estimated that at the present time the number of workpeople concerned by the operative agreements was between one and a half and one and three-quarter million. Since 1926, a number of agreements had either lapsed or terminated, and the Ministry was not aware to what extent individual employers were carrying on the practice of paying for holidays.

The majority of the agreements, it was pointed out, provided that payment should be made for public holidays and for a certain additional period, usually from three to twelve days in each year. Payment for this period was usually conditional on the employee having had six or twelve months' service, either at the date of the holiday or at dates specified in the agreements; while in a number of cases the extent of the holiday was directly governed by the length of service. The service qualification was occasionally linked with a stipulation regarding good time keeping, absence without sufficient cause for more than a specified number of days during the qualifying period resulting in loss of payment for the holiday. Instances also occurred of payment for holidays being made conditional on good conduct and the rendering of satisfactory service. In addition to the general and district agreements, it was known that others were in existence concerning employers in individual firms. Payment to time workers was generally made at the full weekly time rates of wages, and in some instances provision was made for payment to piece-workers on the same basis. In some of the agreements provision was made for allowances to employees who left their employment before they had taken their holiday, although in a few instances such allowance was specifically debarred. In drug and fine chemical manufacture employees leaving before their holidays were due for any reason other than misconduct or resignation, received payment on the basis of one half day for each completed month's service up to a maximum of six days. A few of the agreements provided for a contribution from the workpeople in one form or another towards the payment for holidays.

British Overseas Chemical Trade in April

ACCORDING to the Board of Trade returns for the month ended April 30, 1937, exports of chemicals, drugs, dyes and colours were valued at £2,174,805, as compared with £1,639,143 for April, 1936, an increase of £535,662. Imports were valued at £1,189,050, as compared with £1,082,937 for April, 1936, an increase of £106,113. Re-exports were valued at £49,404.

	Quantities.		Value.			Quantities.		Value.	
	April 30.		April 30.			April 30.		April 30.	
	1936.	1937.	1936.	1937.		1936.	1937.	1936.	1937.
Imports									
Acids—					Quinine and quinine				
Acetic .. cwt.	14,490	16,640	18,964	18,569	salts .. oz.	26,166	92,792	2,374	8,460
Boric (boracic) ..	2,800	7,270	2,799	7,623	Medicinal oils .. cwt.	2,482	2,329	5,282	6,377
Citric ..	1,283	2,613	5,100	10,368	Proprietary medicines				
Tartaric ..	3,298	3,709	13,482	15,707	value	—	—	52,976	50,763
All other sorts .. value	—	—	7,610	5,426	All other sorts ..	—	—	38,080	56,066
Borax .. cwt.	16,116	21,020	9,507	10,774	Dyes and extracts for				
Calcium carbide ..	111,155	147,546	65,165	82,771	tanning—				
Fertilisers, manufactured—					Finished dyestuffs from				
Superphosphate of lime					coal tar .. cwt.	6,873	3,806	184,215	113,164
Tons	8,998	6,252	16,997	13,034	Extracts for dyeing ..	16,287	8,405	21,423	19,806
All other descriptions ..	2,129	509	12,137	2,768	Extracts for tanning (solid				
Phosphorus .. cwt.	—	—	—	—	or liquid)—				
Potassium compounds—					Chestnut .. cwt.	31,460	33,214	21,310	22,351
Caustic and lyes ..	12,378	11,221	13,760	11,548	Quebracho ..	11,856	77,317	10,188	74,617
Chloride (muriate) ..	48,887	52,545	16,075	16,311	All other sorts ..	40,579	88,976	30,285	64,635
Kainite and other mineral					All other dyes and dye-				
fertiliser salts .. cwt.	159,687	127,101	23,018	16,363	stuffs .. cwt.	1,227	1,899	25,221	28,102
Nitrate (saltpetre) ..	10,417	9,112	9,911	5,184	Painters' colours and ma-				
Sulphate ..	24,674	16,860	10,537	7,494	terials—				
All other compounds ..	9,554	12,183	15,493	17,177	White lead (basic car-				
Sodium compounds—					bonate) .. cwt.	6,698	6,940	8,550	10,284
Carbonate, including					Lithopone ..	24,872	25,083	15,563	14,863
crystals, ash and bi-					Ochres and earth colours				
carbonate .. cwt.	42	139	42	118	cwt.	21,661	56,719	7,937	15,921
Chromate and bichro-					Bronze powders ..	1,649	1,792	11,555	12,366
mate .. cwt.	2,408	5,201	3,169	5,483	Carbon Blacks ..	43,410	35,072	63,228	50,552
Cyanide ..	3,001	3,032	7,504	7,112	Other pigments and ex-				
Nitrate ..	40,000	95,140	8,561	20,291	tenders .. cwt.	24,471	39,343	8,330	10,167
All other compounds ..	18,436	22,803	12,500	19,434	All other descriptions ..	12,498	17,473	33,378	36,605
Other Chemical manufac-									
tures .. value	—	—	270,711	300,336	Total .. value	—	—	1,082,937	1,189,050
Drugs, medicines and medi-									
cinal preparations—					Exports				
Acids—					All other sorts ..	59,892	80,994	74,341	92,616
Citric .. cwt.	2,699	4,430	11,817	20,905	Zinc oxide .. tons	1,051	1,939	19,779	44,233
All other sorts .. value	—	—	19,589	34,051	All other descriptions				
Aluminium compounds					.. value	—	—	201,358	239,060
tons	5,011	2,970	50,069	32,305	Drugs, medicines and medi-				
Ammonium compounds—					cinal preparations—				
Sulphate .. tons	17,208	27,180	100,747	158,444	Quinine and quinine				
All other sorts ..	1,451	1,364	15,138	15,805	salts .. oz.	107,639	160,976	11,250	16,759
Bleaching materials—					Proprietary medicines				
Bleaching powder (chlor-					value	—	—	89,192	116,641
ide of lime .. cwt.	40,710	60,127	11,521	16,263	All other descriptions ..	—	—	127,098	140,564
All other sorts ..	4,379	6,445	11,218	15,928	Dyes and extracts for tan-				
Coal tar products—					ning—				
Cresylic acid .. galls.	212,830	268,230	22,127	46,311	Finished dyestuffs from				
Tar oil, creosote oil, an-					coal tar—				
thracene oil ..	1,724,387	2,654,600	42,122	66,706	Alizarine, alizarine red				
All other sorts .. value	—	—	18,734	25,751	and indigo (syn-				
Copper, sulphate of .. tons	1,625	2,148	23,143	47,271	thetic) .. cwt.	1,742	1,849	11,233	9,559
Disinfectants, insecticides,					Other sorts ..	6,661	8,267	91,227	107,884
etc. .. cwt.	31,452	31,193	62,042	64,882	Extracts for tanning (solid				
Fertilisers, manufactured					or liquid) .. cwt.	17,917	22,955	14,394	19,460
tons	12,513	27,399	51,759	71,404	All other descriptions ..	3,372	2,767	9,429	10,491
Glycerine .. cwt.	9,794	14,527	25,178	58,216	Painters' colours and ma-				
Lead compounds ..	10,889	18,180	14,400	31,648	terials—				
Magnesium compounds					Ochres and earth colours				
tons	487	521	11,015	14,061	cwt.	16,267	15,907	14,044	16,956
Potassium compounds cwt.	5,215	6,391	9,178	11,651	Other descriptions ..	21,578	23,495	35,752	41,886
Salt (sodium chloride) tons	17,370	18,664	44,230	52,221	White lead ..	6,369	4,734	13,160	11,220
Sodium compounds—					Paints and painters' ena-				
Carbonate, including					mel, prepared .. cwt.	37,227	54,207	98,979	138,748
crystals, ash and bi-					Varnish and lacquer				
carbonate .. cwt.	343,095	468,146	75,988	94,092	(clear) .. galls.	74,569	76,105	29,151	28,175
Caustic ..	165,329	266,427	80,678	106,658	Printers' ink .. cwt.	4,280	4,110	22,026	26,792
Nitrate ..	17,090	535	5,707	215	All other descriptions ..	36,546	59,130	69,545	122,375
Sulphate, including salt-									
cake .. cwt.	5,946	54,185	785	6,598	Total .. value	—	—	1,639,143	2,174,805
Chemical manufactures					Re-Exports				
and products .. value	—	—	27,602	32,099	ning .. cwt.	2,020	2,435	2,265	2,608
Drugs, medicines and medi-					Painters' colours and ma-				
cinal preparations value	—	—	8,086	13,956	terials .. cwt.	366	248	677	741
Dyes and extracts for tan-					Total .. value	—	—	38,630	49,404

International Nickel Company of Canada

Development of New Alloys

A NET profit of \$11,714,956.82, equivalent to 77 cents per share on the common stock after allowing for preferred dividend, is reported for the first quarter of 1937 in the quarterly statement of the International Nickel Co. of Canada, Ltd. This compares with a net profit of \$9,836,446.26 for the last quarter of 1936, which was equal to 64 cents per share on the common. It compares also with the net profit of \$8,386,787.41, or 54 cents per share, made in the first quarter a year ago. The consolidated balance sheet as at March 31, 1937, shows current assets at \$77,743,235.16 including \$42,726,199.77 in cash. For the first time the balance sheet includes an item of \$8,479,918.75 which represents Canadian and United States Government obligations held against retirement system reserves. The total of earned and capital surplus now amounts to \$122,945,041.00 as compared with \$120,502,643.37 on December 31, 1936.

In a letter to shareholders, Mr. Robert C. Stanley, chairman and president, emphasises the work of the company's development and research department in originating new alloys containing nickel. Since its inception the company's research and development organisation has directed its efforts not only to finding new uses for nickel, but equally to originating new alloys containing nickel. During recent years several such alloys have been perfected and are now established in industrial and engineering uses. One of these new alloys is "K" which offers, in addition to high non-corrosibility, the great strength and other physical properties associated with alloy steel. Thus, as a result of the company's research programme, the engineering properties of a non-ferrous alloy have been raised to those of special steels. "K" is non-magnetic and, like steel, can be hardened or softened by heat treatment. It can be readily forged, machined and welded. "K" and other recently developed non-ferrous alloys definitely broaden the opportunity for nickel to be of service in an industrial era which demands better engineering materials to meet exacting conditions.

Vanadium Catalysts

Poisoning Effects of Arsenic

A NEW apparatus and method of operation for carrying out the catalytic oxidation of sulphur dioxide to trioxide, whereby an inlet gas mixture of absolutely uniform and predetermined composition is maintained, was described by Mr. J. C. Olsen and Mr. J. J. Vetter, in a paper read at the North Carolina meeting of the American Chemical Society last month.

Several catalysts containing vanadium were prepared and a systematic study made of the poisoning effects of arsenic on one of them—prepared in accordance with U.S. Pat. 1,657,754. It is claimed that this catalyst is immune to arsenic poisoning, but the results of this study show that above 4.0 per cent. As_2O_3 its activity decreases and at 24.7 per cent. As_2O_3 it has dropped from an original conversion efficiency of 97.0 per cent. to 76.8 per cent. Similar results were obtained using a sample of a commercial catalyst. The effectiveness with which vanadium catalysts remove arsenic from a gas stream is so high that this catalyst might be used to purify a gas stream.

The results of this investigation show conclusively that vanadium catalysts of the silica base type are not immune to the poisoning effects of arsenic, although the influence is not appreciable below 4.0 per cent. As_2O_3 content of the catalyst. Above this amount arsenic has a marked influence on both the degree and rate of conversion. Higher temperatures of the catalyst tend to effect this to a slight degree. The catalyst base alone, without the vanadium, has little or no catalytic power, hence in the unpoisoned catalyst the vanadium is the active agent.

When arsenic pentoxide was substituted for vanadium in

the catalyst, that is forming an arsenic catalyst, conversions as high as 46.3 per cent. were obtained at 660° C which is 200° higher than the temperature at which the unpoisoned vanadium catalyst gave best results. Therefore a possible explanation of the poisoning effect of arsenic on vanadium catalysts is that the arsenic forms a coating or film of relatively low activity catalyst over the high activity vanadium. The fact that the activity of the arsenic catalyst as well as the vanadium catalyst when poisoned with arsenic tends to increase with increasing temperature tends to support this hypothesis. The activity of the unpoisoned vanadium catalyst decreases with increasing temperature.

Another possible cause of the decreased efficiency may be a change in the physical structure of the catalyst. The unpoisoned catalyst particles could be broken easily, but as the arsenic was added they became increasingly harder finally approaching an almost vitreous condition at 24.7 As_2O_3 . They were then broken only with difficulty in a porcelain mortar, and the volume was decreased by 16 per cent. This vitrified condition is evidently due to a form of arsenic trioxide known as arsenic glass. It is not easily volatilised and would account for the fact that the arsenic remains in the catalyst at temperatures far above the temperatures of sublimation of the ordinary variety of As_2O_3 .

Strontium Minerals

New Economic Report by Imperial Institute

MANY interesting facts are brought together in the latest publication on "Strontium Minerals" just issued by the Mineral Resources Department of the Imperial Institute (price 1s. 6d.). The monograph has been written by Mr. E. H. Beard, a senior member of the Intelligence and Technical Staff, and may claim to be the most up-to-date and comprehensive treatise on the production, utilisation and occurrence of these minerals.

Among the salient facts presented, it is pointed out that for many years the British Empire has been the world's most important source of strontium, the naturally occurring strontium sulphate or celestite deposits of the British district, Gloucestershire, constituting in normal times almost the only economic occurrence of this mineral. Important deposits of strontianite, or natural strontium carbonate, occur in Westphalia, Germany, but production has been seriously curtailed during recent years owing largely to competition with English celestite. Although in the past, the bulk of the English supplies has been shipped to Germany for the manufacture of strontium compounds, some of which were later imported into the United Kingdom for consumption, attempts are now being made to establish a strontium salt industry near Birmingham.

Strontium compounds are put to a variety of uses, especially in the beet-sugar industry; in the manufacture of fireworks, flares, torches and signals; as fillers in the seals of electric batteries, in water-paint distempers, asphalt surfacing material and rubber; as "cleaners" for removing sulphur and phosphorus from special steels; as precipitants in the purification of caustic soda; in certain refrigerators; and in the chemical, pharmaceutical and ceramic industries. Certain of the salts are regarded as essential war materials, particularly for the manufacture of some tracer-bullets and red flares.

A special feature of this new monograph is the literature dealing with the metallurgical uses of the mineral strontianite, and also of strontium metals and alloys. Information on this subject has not been easily available in the past, so that the account now given will doubtless be welcomed by iron and steel technologists. Other features include hitherto unpublished analyses of English celestite recently exported from Bristol Docks, valuable details regarding the registered imports of strontium compounds into the United Kingdom during the period 1934 to 1936 inclusive, and a section on prices of strontium minerals and compounds.

References to Current Literature

British

- ORGANIC.—The formation and decomposition of quaternary ammonium salts in solution. W. Cule-Davies and R. G. Cox, *J.C.S.*, 1937, 614-621.
- CARBON.—Carbon black: The Channel process: Production from pyrolysis waste gases. L. M. Pidgeon, *Canadian J. Research*, 15, B, 139-155.
- BLEACHING.—Methods for improving the efficiency of hypochlorite bleach liquors. A. J. Hall, *Textile Mercury*, 96, 481-483.
- INORGANIC.—The action of alkalis on refractory materials. F. H. Clews, A. Green and A. T. Green, *Trans. Ceramic Soc.*, 36, 173-200.
- WATER.—Water treatment in the dyeing industry. S. C. Turner, *Dyer*, 77, 491-493.
- CATALYSTS.—Modern organic syntheses: The metallic oxides as catalysts. P. Frolich, *Chem. Trade J.*, 100, 427-428.
- PIGMENTS.—The co-ordination theory in pigments. F. H. Burstall, *Paint Manufacture*, 7, 141-143.
- The colorimetry of pigments: Practical methods of testing. D. L. Tilleard, *J. Oil Colour Chem. Assoc.*, 20, 149-163.
- SULPHUR.—The determination of recoverable sulphur in gas liquor. *J. Soc. Chem. Ind.*, 56, 114-115 T.
- Detergent action and its relation to wetting and emulsification. N. K. Adam, *J. Soc. Dyers Colourists*, 53, 121-129.
- Quinine sulphate as a fluorescent indicator for precipitation reactions. J. Grant, *Analyst*, 62, 285-286.
- MISCELLANEOUS.—Acid salts of monobasic organic acids. J. D. M. Ross, T. J. Morrison and C. Johnstone, *J.C.S.*, 1937, 608-614.

American

- ORGANIC.—Hydro-polymerisation. V. N. Ipatieff and V. I. Komarewski, *J. Amer. Chem. Soc.*, 59, 720-722.
- ANALYSIS.—A titration solution using diphenylamine indicator. W. K. Gibson, *Chem. Analyst*, 26, 29-30.
- Tannic acid in analysis. C. Franklin-Miller, *Chem. Analyst*, 26, 38-39.
- PIGMENTS.—Zinc pigments. H. A. Nelson, *Paint Oil Chem. Rev.*, 99, No. 8, 16-18, 47.
- GLASS.—The chemistry of coloured glass. W. Weyle, *Glass Industry*, 18, 167-171.
- ADSORPTION.—Activated sorption of hydrogen on chromic oxide gel. L. Clarke, L. S. Kassel and H. H. Storch, *J. Amer. Chem. Soc.*, 59, 736-740.
- MISCELLANEOUS.—Agricultural insecticides. R. B. Stoddard, *Soap*, 13, 95-99.

German

- ALDEHYDES.—Formaldehyde from percarbonates. E. Baur, *Helv. Chim. Acta*, 20, 398-401.
- SOAPS.—The potentiometric titration of the sodium salts of fatty acids. A. Lottermoser and A. K. Ghose, *Kolloid Beihefte*, 45, 253-302.
- The preparation of solvent-containing soaps. E. Pyhala, *Ole Fette Wachse*, 1937, No. 4, 1-6.
- ETHERS.—On the addition of alcohols to double compounds: Ethers from unsaturated cyclic hydrocarbons and from the two pinenes. W. Treibs, *Ber.*, 70, 589-594.
- FATS.—Anti-oxidants and stabilizers for fats. F. Wittka, *Chem. Ztg.*, 61, 386-388.
- VITAMINS.—Synthesis of Vitamin A. R. Kuhn and C. J. O. R. Morris, *Ber.*, 70, 853-858.
- INORGANIC.—Some new halogen salts of rhodium. J. Meyer and K. Hoehne, *Z. anorg. Chem.*, 231, 372-382.
- TEXTILES.—The absorption of acids by wool. H. J. Henk, *Melliand Textilber*, 18, 377-378.

ANALYSIS.—The application of conductometric processes with visual indication to micro-chemical research: The titration of small amounts of lead, cadmium, copper, silver, and bismuth with hydrogen sulphide, etc. G. Jander and H. Emmig, *Z. Elektrochem.*, 43, 207-215.

Analytical determination of ethylene oxide? F. W. Kerkow, *Z. analyt. Chem.*, 108, 249-254.

Some applications of perchloric acid in the iron foundry laboratory: Determination of silicon, manganese and phosphorus. A. Raab, *Angew. Chem.*, 50, 327.

ORGANIC.—Selenium-substituted amino acids. A. Fredga, *Svensk Kem. Tidskrift*, 49, 124-130.

The reaction between tanning agents and the albuminous bodies in hides. A. Kuntzel, *Angew. Chem.*, 50, 308-313.

The micro-determination of hydroxyl and amino groups. F. H. Stodola, *Mikrochem.*, 21, 180-183.

Ethyl sulphinic acid ethyl ester. A. Meuwesen and H. Gebhardt, *Ber.*, 70, 792-796.

TANNING.—Investigations on vegetable tanning agents, synthetic tanning agents, and sulphite cellulose waste lyes. W. Schiller, *Gerber*, 63, 27-32.

RESINS.—Researches on the resins. E. Stock, *Farber-Ztg.*, 42, 459-460.

LACQUERS.—Stove-lacquers from phthalic acid resins. K. Scholz, *Farbe u. Lack*, 1937, No. 15, 173-174.

RUBBER.—On dispersing agents and softeners. J. Behre, *Kautschuk*, 13, 49-60.

ADHESIVES.—Artificial substances as glues and adhesives. F. Ohl, *Gelatine Leim Klebstoffe*, 5, 35-43.

MISCELLANEOUS.—Alkali-free washing agents. J. Hetzer, *Ole Fette Wachse*, 1937, No. 4, 9.

The analysis of impregnated cloth. G. Durst, *Melliand Textilber.*, 18, 372-373.

The estimation of oxygen in metals. W. Jander and A. Krieger, *Z. anorg. Chem.*, 232, 57-60.

The determination of oxygen by activation of alkaline earth oxide cathodes. H. Isensee, *Z. phys. Chem.*, 35, 309-316.

French

INORGANIC.—On the green basic carbonates of copper. O. Binder, *Compt. rend.*, 204, 1,200-1,202.

ANALYSIS.—Investigations of organic reagents which can be used in mineral analysis. R. Duckert, *Helv. Chim. Acta*, 20, 362-367.

CELLULOSE.—The decomposition of cellulose xanthate by water in the manufacture of transparent foils. I. Sokolov, *Rev. Univ. Soil Text. Art.*, 12, 137-141.

FUELS.—Liquid fuels produced by the carbonisation of raw oleaginous seeds. F. Michot-Dupont, *Bull. Assoc. Chim.*, 54, 438-448.

ORGANIC.—Some derivatives of amino-naphthol. H. Goldstein and P. Gardinol, *Helv. Chim. Acta*, 20, 516-520.

Derivatives of oxidation products of glycerol. H. P. Den Otter, *Rec. Trav. Chim. Pays-Bas*, 56, 474-491.

Recent researches in nitrogen- and sulphur-containing cyclic compounds. H. Wuyts, *Bull. Soc. Chim. Belge*, 46, 27-45.

MISCELLANEOUS.—Investigations of some chlorocarbonates. A. Perret and J. Biechler, *Bull. Soc. Industrielle Mulhouse*, 103, 168-173.

Recent chemical revelations in the treatment of silk. *Rev. Teint. Ind. Text. Blanch.*, 52, 119-120.

Relationship between the chemical properties and the colour of methoxybenzophenone oximes and their derivatives. M. Martinoff, *Annal. Chim.*, 7, 421-492.

BORIC Acid is now being manufactured in the Krasny Chimik Factory at Leningrad using a process developed in the Union Institute for Fertilisers and Insecticides.

Personal Notes

MAJOR JAMES GARDINER has been appointed by the Secretary for Mines to be a member of the Board for Mining Examinations, in succession to Mr. Jesse Wallwork, who has resigned.

MR. JOSIAH BLACKWELL, of Moseley, Birmingham, chairman of Blackwell, Hayes and Co., manufacturing chemists, left estate valued at £51,467, with net personalty £51,347.

MR. H. V. POTTER, B.Sc., F.I.C., past chairman of the Plastics Group of the Society of Chemical Industry and managing director of Bakelite, Ltd., has been elected a member of the Institution of Chemical Engineers. Mr. Potter is sailing for the United States on May 29, and will be the official representative of the Society of Chemical Industry at the forthcoming Semicentennial of the Engineering Institute of Canada at Montreal and later at Ottawa.

MR. A. E. HILLS, the donor of the new chemistry block at the University of Birmingham, has made a further benefaction of £25,000 to be used for the provision of post-graduate scholarships open to all students of the University who have taken a bachelor's degree and have shown themselves qualified for post-graduate work. These scholarships, of a minimum value of £150 and a maximum tenure of two years, will be known as the A. E. Hill Post-Graduate Scholarships. They may be used for study at any place approved by the council of the University.

MR. W. A. PAYNE, chairman and managing director of the British Thermostat Co., Ltd., died on May 6, after a short illness. Mr. Payne, and his brother, Captain M. Payne, who died on February 6 this year, were, with Mr. J. E. Sherlock, the founders of the British Thermostat Co., Ltd., which commenced operations in 1928. Mr. Payne was 38, and leaves a widow. His death has caused a vacancy on the board, which has been filled by appointing Mr. J. E. Sherlock and Mr. W. F. F. Martin-Hurst joint managing directors, and by electing Mr. F. G. Poplett to the board.

MR. FOSTER DEE SNELL, who has resigned the secretaryship of the American Section of the Society of Chemical Industry after 12 years' service, has been presented with a gold watch in appreciation of his services.

MR. ANDREW MORE, deputy Government Chemist, was among the recipients of the Companionship of the Imperial Service Order (Home Civil Service) announced in the Coronation Honours list last week.

THE ENGAGEMENT WAS ANNOUNCED on Tuesday, of Mr. Christopher Benn, youngest son of Sir Ernest Benn (chairman of Benn Brothers, Ltd., publishers of THE CHEMICAL AGE) and Lady Benn, to Phyllis, second daughter of Mr. and Mrs. Preston, of Slaughtam Park, Sussex.

MR. EDWARD ODDIE, for 22 years manager of Taylor and Nicholson, Ltd., bleachworks, Walmersley, Bury, Lancashire, retired on May 14, after 44 years' service with the company. On May 13 the workpeople made a presentation to him which took the form of a chiming grandmother clock, and a leather handbag was presented to Mrs. Oddie. In the evening of the same day there was another presentation when a travelling case, the gift of the staff, was presented to Mr. Oddie along with an umbrella for Mrs. Oddie.

PROFESSOR A. R. LING, M.Sc. (Birmingham), F.I.C., Professor of Malting and Brewing and of the Biochemistry of Fermentation in the University of Birmingham from 1920 to 1931, and since 1931 Emeritus Professor, died at Edgbaston on May 14, at the age of 76. He was for a time assistant chemist to the London Beetroot Sugar Association and a few years afterwards became chief chemist. From 1895 to 1920 he edited the *Journal of the Institute of Brewing*, and he was for many years lecturer on the fermentation industries at the Sir John Cass Institute. Professor Ling was the author of numerous papers dealing with researches in chemistry.

From Week to Week

AN IMPORTANT DISCOVERY OF IRON ORE has been made in the Malay state of Johore, where iron mines are being worked extensively by Japanese. It is stated officially that the discovery is likely to develop into a producer of the first magnitude.

TWO MEN WERE KILLED by fumes from a vat at Carsbridge Distillery, Alloa, belonging to the Distillers' Company, Ltd., on May 12. The men were Alexander Graham, of Clackmannau, and John Henderson, of Sauchie. Graham was taking the temperature readings of a vat when the thermometer which he was using slipped from his hand and fell into the vat where wash to a depth of seven inches was fermenting. In order to retrieve the thermometer, he went down a ladder and was overcome by the fumes. Henderson observed the plight of his workmate, made an heroic attempt to rescue him, but was also overcome.

THE CHEMICAL AGE LAWN TENNIS TOURNAMENT

FIRST ROUND CLOSES MAY 31.

Competitors in THE CHEMICAL AGE Lawn Tennis Tournament are reminded that results of all matches in the first round must reach the Editor of THE CHEMICAL AGE not later than Monday week, May 31. Full particulars of the draw, with names and addresses of competitors, were published in THE CHEMICAL AGE of May 8.

LORD LEVERHULME, president of the Society of Chemical Industry, speaking at the opening of the conference of the United Commercial Travellers' Association at Cheltenham, on Monday, said there was a danger of personality in the commercial traveller becoming lost in a bewildering mist of scientific elaboration. In a scientific age there was a danger that people would believe that every problem could be solved by scientific planning, that national and international trade could be canalised so as to flow precisely in those directions in which the scientific planners and politicians wished it to flow. Trade flowed most easily when the consumer demand regulated it, not when it sought to regulate the consumer demand. One of the most important links between a manufacturer and his consumers was the commercial traveller. However precise the commercial traveller sales organisation, a salesman could never be a mere cog in a machine, a kind of robot repeating selling-talk written for him by someone else and automatically booking orders as the result. There was the factor of personality and no amount of market research or of scientific sales planning could enable a manufacturer to dispense with personality in his commercial travellers.

COMMENTING ON THE NEW DUTY of 125 marks per double hundredweight imposed by Germany on imports of rubber, Professor van Gelderen, chief of the Economic Department of the Dutch Colonial Office, states that the production of synthetic rubber in Germany constitutes no danger to world rubber production. The anticipated German production of 1,500 tons of the synthetic product a year is of no importance in comparison with the 70,000 tons a year that Germany needed.

THE ANNUAL MEETING of the Finsbury Technical College Old Students' Association was held last week when the new council was elected as follows:—President, Professor C. H. Desch; immediate past president, Mr. C. B. Nadaud; members of council, Mr. H. P. Guy, Mr. E. W. Moss, and Mr. B. H. Bowles; secretary, Mr. F. R. C. Rouse; treasurer, Mr. W. B. Thompson. The annual dinner was held at the Trocadero. There was a record attendance of 125 members and guests.

COMMENTING UPON the National Defence Contribution, Mr. Clarence Bartholomew, chairman of the British Match Corporation, said at the annual meeting of the Corporation on Tuesday that his considered opinion must be reserved until they could see the details of this new and milder form of the crude Excess Profits Duty, which did so much mischief in its hasty wartime guise. In principle he considered the new tax quite unfair, unless it could be confined only to those who were making excess profits from the Government's necessary rearmament programme. If it was to apply to all industry, the new tax discriminated between investors of different classes, and added an additional burden to those concerns which, when their profits increased, would in any case pay increased income-tax. That was no light matter with income-tax at 5s. in the pound.

THE DIRECTORS of B. Laporte, Ltd., in their thirtieth annual report, state that a decrease of £5,941 in the trading profit as against the previous year, is accounted for mainly by increased wages to workmen, and partly by increased cost of fuel and other raw materials. Concurrently, there have been moderate upward and downward movements of home and export prices of the more important manufactured products. The net result of price adjustments has been in favour of customers, and the directors consider that this result, together with the wage increases, has strengthened the position of the company. A new subsidiary company has been formed in Sydney, Australia, to take over the business of an associated company and to manufacture hydrogen peroxide under licence from the company, for the Australian market. Plant and buildings are being erected on a new site, but trading has not yet commenced. The new laboratories are now in use, and the buildings released by the erection of new offices and laboratories have been remodelled as dining, cloak, first-aid and bath rooms for the employees.

THE TREASURY, on the recommendation of the Import Duties Advisory Committee, has issued the Import Duties (Drawback) (No. 4) Order, 1937 (S.R. and O. 1937, No. 415), increasing the rates of drawback in respect of soya beans used in the manufacture of soya bean oil and soya bean flour. The increases are consequent upon the rise in the price of imported soya beans, and took effect as from May 14.

THE APRIL RETURNS of china clay shipments are most encouraging and reflect the general industrial improvement which has set in. According to the latest information there is every hope that even the highest peak of production reached in 1912 will soon be overtaken, and exceeded. An interesting feature of the month's trade is that the china stone trade has made a record increase, practically the highest since the war. The details are as follows:—Fowey, 58,610 tons china clay; 3,675 tons china stone; 2,295 tons ball clay. Par, 11,094 tons china clay; 268 tons china stone. Charlestown, 7,149 tons china clay; 1,603 tons china stone. Padstow, 790 tons china clay. Plymouth, 216 tons china clay; Newham, 105 tons china clay. By rail throughout, 6,706 tons china clay, making an aggregate of 92,511 tons against 87,128 tons for the previous month of March.

TWO PRIVATE EXHIBITIONS—one at the Cutlers' Hall, Sheffield, from May 25 to 28, and the other at the Royal Station Hotel, Newcastle, from June 1 to 4—have been arranged by E. Leitz (London), who will show all types of optical instruments for research and routine work, both microscopes for examination of structure and precision measuring instruments. The scope of the exhibition in each case will be approximately the same as that of the company's stand at the recent International Congress for Testing Materials in London.

THE BRITISH CAST IRON RESEARCH ASSOCIATION has issued a circular letter relating to the British Foundry School. It states that requests are constantly received by the Association and other bodies for suggestions regarding men as foundry executives, metallurgists, chemists or engineers, either in a senior or junior capacity. Such requests are very difficult to meet. The British Foundry School was therefore formed to enable firms to train their own men by picking out promising young men with some practical experience and technical knowledge and sending them for the course. The School does not train men from outside the industry, because manufacturers themselves are the best judges of the suitability of men for training.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

METHODS OF INCREASING THE PERMEABILITY OF SILICON IRON.—Heraeus-Vacuumschmelze A.-G. Oct. 29, 1935. 26102/36.

MANUFACTURE OF POLYMETHINE DYE STUFFS and of sensitized photographic emulsions.—I. G. Farbenindustrie. Oct. 31, 1935. 27237/36.

MANUFACTURE OF ASPHALTIC or bituminous emulsions.—O. Ovregeard. Oct. 29, 1935. 28213/36.

PROCESS FOR THE MANUFACTURE OF HYDROCARBON MIXTURES containing a high percentage of alkenes of high molecular weight.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 1, 1935. 28436/36.

Specifications Accepted with Date of Application

TREATMENT OF MATERIALS CONTAINING OR SECERNING PROTEOLYTIC ENZYMES.—Aktieselskabet Dansk Gærings-Industri. Oct. 26, 1934. 464,857.

PROCESS FOR THE CONTINUOUS PRODUCTION OF METALLIC MAGNESIUM by thermal reduction.—I. G. Farbenindustrie. Aug. 2, 1934. 465,097.

PROCESS OF CHLORINATING METHYL-AROMATIC COMPOUNDS.—W. W. Groves (I. G. Farbenindustrie). Sept. 17, 1935. 464,859.

PROCESS FOR WATERPROOFING TEXTILE MATERIALS.—W. W. Groves (I. G. Farbenindustrie). Sept. 17, 1935. 464,860.

MANUFACTURE OF AROMATIC CARBOXYLIC ACID CHLORIDES.—W. W. Groves (I. G. Farbenindustrie). Oct. 22, 1935. 465,038.

PROCESS FOR THE MANUFACTURE AND PRODUCTION OF COMPOUNDS of the anthracene series.—G. W. Johnson (I. G. Farbenindustrie). Oct. 23, 1935. 465,040.

MANUFACTURE AND PRODUCTION OF SULPHATES AND SULPHUR.—G. W. Johnson (I. G. Farbenindustrie). Oct. 24, 1935. 465,042.

CARBONISATION OF MIXTURES OF OIL and solid carbonaceous materials.—J. L. Strevens and W. B. Mitford. Oct. 26, 1935. 465,047.

PROCESS FOR THE IMPROVEMENT OF OILS, fats, and the like.—Dr. W. Ekhard. Oct. 26, 1935. 465,111.

PROCESS OF CLEANING AND COATING METAL SURFACES.—H. D. Elkington (Rust Proofing Co. of Canada, Ltd.). Oct. 26, 1935. 464,982.

TREATMENT OF DIRECT DYE STUFFS.—Chemical works, formerly Sandoz. Nov. 1, 1934. 464,921.

MANUFACTURE OF METHANE.—British Celanese, Ltd., R. Page and E. B. Thomas. Oct. 29, 1935. 465,157.

COATING OF METAL ELECTROLYTICALLY.—Sir M. Hicks, A. R. N. Heath and T. C. Tapp. Oct. 31, 1935. 465,123.

MANUFACTURE OF COLOURED LACQUERS and film-forming coating compositions.—W. W. Groves (J. R. Geigy). Oct. 31, 1935. 465,167.

PROCESS FOR UNITING CELLULOSE ACETATE and GELATINE LAYERS.—Triplex Safety Glass Co., Ltd., and J. Wilson. Nov. 1, 1935. 465,134.

CARBONISATION OF COAL.—E. Blumner. Nov. 1, 1935. 465,067.

MANUFACTURE AND PRODUCTION OF HYDROGEN PEROXIDE.—G. W. Johnson (I. G. Farbenindustrie). Nov. 4, 1935. 465,070.

PROCESS FOR THE MANUFACTURE OF POLYAZO-DYE STUFFS.—A. Carpmal (I. G. Farbenindustrie). Nov. 4, 1935. 465,174.

PRODUCTION OF ACETYLENE by heating hydrocarbon gases for a short time.—Ruhchemie A.-G. Aug. 19, 1935. 465,183.

PRODUCTION OF VALUABLE PRODUCTS FROM MERCAPTANS and unsaturated hydrocarbons.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. March 18, 1935. 464,951.

PRODUCTION OF VALUABLE PRODUCTS FROM UNSATURATED HYDROCARBONS and hydrogen sulphide.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. March 18, 1935. 464,952.

METHOD OF PREPARING ALUMINIUM and its alloys for electro-deposition.—Dr. Finckh Ges. April 9, 1935. 465,078.

PROCESS FOR EFFECTING THE CATALYST DEHYDROGENATION OF HYDROCARBONS.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 26, 1935. 464,957.

TREATMENT OF TEXTILE MATERIALS.—A. G. Norman, and S. G. Barker. June 26, 1936. 464,972.

CATALYTIC HYDROGENATION OF POLYMERS of unsaturated hydrocarbons.—International Hydrogenation Patents Co., Ltd. Sept. 28, 1935. 465,024.

PROCESS FOR DETERMINING THE EXCESS AMOUNT OF OXIDISING AGENT in chemically purified water.—A. Schnorf. Oct. 9, 1935. 464,902.

MANUFACTURE OR TREATMENT OF CELLULOSE DERIVATIVES.—British Celanese, Ltd. Nov. 21, 1935. 465,028.

Applications for Patents

MANUFACTURE OF DIALKOXY SUBSTITUTED β -GLYCOLS.—Wacker Ges. für Elektrochemische Industrie Ges., A. (Germany, May 9, '36.) 10618.

TREATMENT OF SUBSTANCES CONTAINING TANTALUM AND NIOBIUM.—W. W. Triggs (Soc. Generale Metallurgique de Hoboken). 10122, 10348, 10532.

MANUFACTURING FLUORESCENT MATERIALS.—British Thomson-Houston Co., Ltd. (United States, April 22, '36.) 11286, 11287, 11288.

PREPARATION OF ALPHA-BETA UNSATURATED KETONES.—Carbide and Carbon Chemicals Corporation. (United States, May 8, '36.) 10689.

MANUFACTURE OF VAT DYE STUFFS.—A. Carpmal (I. G. Farbenindustrie.) 11300.

MANUFACTURE OF COMPOSITIONS comprising softening agents.—A. Carpmal (I. G. Farbenindustrie.) 11434.

MANUFACTURE OF LEUCO SULPHURIC ACID ESTERS of vat dyestuffs.—A. Carpmal (I. G. Farbenindustrie.) 11435.

PROCESSES FOR WORKING-UP AQUEOUS FORMALDEHYDE SOLUTIONS. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. (Germany, May 8, '36.) 11327, 11328.

ORGANIC MATERIALS.—H. Dreyfus. 10753.

PRODUCTION OF ORGANIC COMPOUNDS.—H. Dreyfus. 10754.

STABILISATION OF CHLORINATED HYDROCARBONS.—A. I. S. Duncan, J. W. C. Crawford, and Imperial Chemical Industries, Ltd. 10967.

MANUFACTURE OF ADIPONITRILE.—E. I. du Pont de Nemours and Co. (United States, April 21, '36.) 11448.

MANUFACTURE OF ADIPONITRILE.—E. I. du Pont de Nemours and Co. (United States, March 26.) 11449.

MANUFACTURE OF MORDANT AZO-DYE STUFFS.—Durand and Huguenin, A.-G. (Germany, April 20, '36.) 11265.

MANUFACTURE OF ALKALI CELLULOSE.—W. W. Groves (I. G. Farbenindustrie.) 11262.

MANUFACTURE OF METHYLGLYOXAL.—W. W. Groves (I. G. Farbenindustrie.) 11267.

MANUFACTURE OF *n*-BUTYRALDEHYDE.—W. W. Groves (I. G. Farbenindustrie.) 11389.

MANUFACTURE OF ACID TRIPHENYL-METHANE DYE STUFFS.—W. W. Groves (I. G. Farbenindustrie.) 11390.

MANUFACTURE OF ORGANIC NITROGEN COMPOUNDS.—Henkel and Cie. Ges. (Germany, June 16, '36.) 10820.

- ANTHRAQUINONE ACID DYESTUFFS.—R. N. Heslop, W. W. Tatum and Imperial Chemical Industries, Ltd. 10821.
- IRON DESULPHURISATION.—R. P. Heuer. (United States, Aug. 19, '36.) 11006.
- IRON DESULPHURISATION.—R. P. Heuer. (United States, Feb. 1.) 11007.
- HAIR DYES.—I. G. Farbenindustrie, A.-G. (Germany, May 8, '36.) 10748.
- MANUFACTURE OF SULPHUR DYESTUFFS.—I. G. Farbenindustrie. (Germany, May 23, '36.) 10749.
- MANUFACTURE OF SULPHUR DYESTUFFS.—I. G. Farbenindustrie. (Germany, June 16, '36.) 10911.
- MANUFACTURE, ETC., OF AZO DYESTUFFS.—I. G. Farbenindustrie. 10936.
- MANUFACTURE OF WHITE PIGMENTS.—I. G. Farbenindustrie. (Germany, April 17, '36.) 10940.
- CLEANSING AGENTS.—I. G. Farbenindustrie. (Germany, May 7, '36.) 10973.
- MANUFACTURE OF TITANIUM PIGMENTS.—I. G. Farbenindustrie. (Germany, April 17, '36.) 11149.
- MANUFACTURE, ETC., OF COMBUSTIBLE GASES.—I. G. Farbenindustrie. (Germany, April 21, '36.) 11284.
- COLOURING ACETATE ARTIFICIAL SILK.—Imperial Chemical Industries, Ltd. 11450.
- SPRAY COMPOSITIONS for control of horticultural parasites.—L. Mellersh-Jackson (Standard Oil Co. of California). 10925.
- MANUFACTURE, ETC., OF AZO DYESTUFFS.—G. W. Johnson. 10936.
- MANUFACTURE, ETC., OF LUBRICANTS.—G. W. Johnson (I. G. Farbenindustrie.) 10781.
- MANUFACTURE, ETC., OF DYESTUFFS.—G. W. Johnson. 10782.
- MANUFACTURE, ETC., OF DRYING OILS.—G. W. Johnson. 11110, 11111.
- MANUFACTURE, ETC., OF SYNTHETIC TANNING AGENTS.—G. W. Johnson. 11283.
- MANUFACTURE, ETC., OF AZO DYESTUFFS.—G. W. Johnson. 11419.
- MANUFACTURE, ETC., OF AZOMETHINE DYESTUFFS containing metal. G. W. Johnson. 11420.
- HIGH-VACUUM DISTILLATION OF VITAMIN D, ETC.—Kodak, Ltd. 11221.
- PRODUCTION OF COARSELY CRYSTALLINE AMMONIUM SULPHATE, ETC.—H. Kopper's Industrielle Maatschappij N.V. (Germany, April 20, '36.) 11326.
- MANUFACTURE OF LUBRICATING OILS.—W. A. Macfarlane. 11079.
- HYDROGENATION OF CARBONACEOUS MATERIALS.—H. E. Potts (International Hydrogenation Patents Co.). 10688, 11219.
- PRODUCTION OF CONCENTRATED SOLUTIONS in an acid medium.—E. Schueller. 10895.
- MANUFACTURE OF PRODUCTS prepared by means of casein rendered soluble with an acid reaction.—E. Schueller. 10951.
- MANUFACTURE OF HIGHER ALCOHOLS.—Standard Alcohol Co. (United States, June 6, '36.) 11364.
- PROCESS OF STABILISING GASOLINES.—Naamlooze Vennootschap Nieuwe Oetroot Maatschappij. (United States, April 25, '36.) 11016.
- MANUFACTURE OF DERIVATIVES OF HYDROCARBONS of high molecular weight.—Soc. of Chemical Industry in Basle. (Switzerland, April 29, '36.) 11266.
- PRODUCTION OF SODIUM POLYSILICATES.—W. H. A. Thiemann (I. G. Farbenindustrie.) 10892.
- MANUFACTURE OF DIARYL ARYLENE DIAMINES.—United States Rubber Products, Inc. (United States, April 18, '36.) 10894.
- CONVERSION OF ALIPHATIC HYDROCARBONS.—Universal Oil Products Co. (United States, Sept. 30, '36.) 11462.
- DEHYDROGENATION OF ALIPHATIC HYDROCARBONS.—Universal Oil Products Co. (United States, Oct. 15, '36.) 11463.
- MANUFACTURE OF ELASTIC ARTICLES from polyvinyl alcohols.—H. Vohrer. (Germany, Aug. 13, '36.) 11008.
- PRODUCTION OF ORGANIC FERTILISERS.—Wellesley Holdings, Ltd., and C. S. Townsend. 11104.
- PROCESS FOR OBTAINING SULPHUR from gases containing hydrogen sulphide.—Zahn and Co., Ges., and K. Dreyer. 11023.
- MANUFACTURE OF SUBDIVIDED CALCIUM CARBIDE.—A.-G. für Stickstoffdünger. (Germany, May 19, '36.) 11879.
- PROCESS FOR PREPARING A CONCENTRATED RUBBER DISPERSION from rubberlatex.—Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra. (Holland, April 10.) 11941.
- TREATMENT OF TEXTILE MATERIALS.—J. Allan, and J. A. Wainwright. 11800.
- PROTECTIVE COATING OF MAGNESIUM and magnesium alloys.—Aluminium Protection Co., Ltd. 11535.
- PRODUCTION OF FERRO-SILICON.—Austin Motor Co., Ltd., and J. J. Sheehan. 11588.
- MANUFACTURE OF SYNTHETIC RESINS.—British Celanese, Ltd., and W. H. Moss. (Jan. 2, '36.) 11715.
- ELASTIC FLUID TURBINES.—British Thomson-Houston Co., Ltd. (United States, April 22, '36.) 11545.
- MANUFACTURING LUMINESCENT MATERIALS.—British Thomson-Houston Co., Ltd. (United States, April 22, '36.) 11546.
- MANUFACTURE OF IMPROVED RUBBER COMPOSITIONS.—A. Carpmæl (I. G. Farbenindustrie.) 11567.
- MANUFACTURE OF 1,3-DIAZOANTHRAQUINONES.—A. Carpmæl (I. G. Farbenindustrie.) 11568.
- PROCESS FOR TREATING FIBROUS MATERIALS with coagulable substances.—Cellulose Holdings, Ltd. (United States, March 25.) 11741.
- TREATMENT OF GASES FROM FURNACES for production of aluminium.—Det Norske Aktieselskab for Elektrokemisk Industri. (Norway, April 25, '36.) 11574.
- MANUFACTURE OF COUPLING COMPONENTS and azo dyestuffs therefrom.—A. Carpmæl (I. G. Farbenindustrie.) 12170.
- PROCESSES, ETC., FOR REMOVING SCALE and freeing gas from water.—L. Dingeldein. (Germany, April 23, '36.) 11698.

Chemical and Allied Stocks and Shares

THE general tendency in the stock and share markets has been dull and prices have again shown moderate movements against holders. The disposition is to await final details of the National Defence Contribution tax, expected this month, for confirmation of the belief that it will be framed so as to be reasonably equitable in its incidence as between various classes of companies.

Boots Pure Drug at 51s. 6d. are little changed as compared with a week ago. Distillers at 114s. 6d. have lost nearly all the improvement recorded a week ago, but market men are continuing to talk of the possibility of a larger dividend or a bonus of some kind. Borax Consolidated at 31s. 9d. are unchanged. Sangers at 25s. 3d. proved another fairly steady feature, hopes that the dividend will be maintained having continued to influence sentiment. Timothy Whites and Taylors moved up from 31s. 3d. to 32s. 9d. United Molasses were lower at 30s. 3d., the increase in the interim having been rather less than was expected; but it is realised that it is the company's custom to pay much the larger part of its distribution as a final dividend. Triplex Safety Glass were lower at 63s. This was attributed mainly to market conditions as the general assumption is that, despite the much larger capital resulting from the bonus, a dividend of 30 or 35 per cent. seems a reasonable expectation. Unilever continued to attract attention on the statements at the recent meeting and have been maintained around 42s., while there was a better trend in British Oil and Cake Mills preferred ordinary. Levers preference kept the higher prices made recently. More attention continued to be given to Cooper, McDougall and Robertson; business was recorded up to the higher price of 36s. 9d.

Greiff-Chemicals Holdings 5s. shares were around 8s. 6d. Beechams Pills deferred were active at higher prices, having remained under the influence of the statements at the recent meeting, and Griffiths Hughes Proprietaries ordinary shares were better on hopes that the dividend will be maintained. General

Refractories were good, there having been further improvement on the week from 28s. 6d. to 30s. The shares of this company are being classed as offering an indirect means of acquiring an interest in the iron and steel industry because the latter is regarded as its chief customer. British Industrial Plastics were again 28s. 10½d. Erinoid were lower on the reduced profits for the half year shown in the progress report.

Fison, Packard and Prentice were lower on balance at 38s. 9d. but there was a firmer trend reported in the new 5½ per cent. preference. The latter are 10s. paid at present and are quoted at a premium of 3d. British Oxygen were better on the full results, which show a further excellent increase in profits. As previously announced, the company is distributing a scrip bonus in addition to maintaining the dividend at 15 per cent. B. Laporte were done at the lower price of 115s. following the dividend announcement; it is expected the results will show the directors are again dealing very conservatively with profits.

Dorman Long, Consett Iron, Richard Thomas and most other iron, steel and similar shares were inclined to move against holders as there is a general inclination to await full information regarding the N.D.C. tax. Most companies in the heavy industries have reorganised their capital in recent years and it is hoped that in framing the tax due allowance will be made for this and for the low earning capacity shown a few years ago when in many cases it was not possible to make adequate allowance for depreciation and similar charges.

Imperial Chemical have lost nearly 1s. to 37s. 6d., but this is being attributed to market conditions which usually influence prominently active shares. Similar remarks apply in the case of Turner and Newall, which are 95s. 7½d. at the time of writing, compared with 97s. 6d. a week ago. Associated Portland Cement improved moderately to 96s. 10½d., but British Plaster Board at 39s. have lost 1s. "Shell" and Anglo-Iranian were better among oil shares, awaiting the impending dividend announcements.

Weekly Prices of British Chemical Products

THERE are no price changes to report in the London markets for general heavy chemicals, rubber chemicals, wood distillation products, perfumery chemicals, essential oils and intermediates. In the coal tar products section there have been advances of 2d. per gal. in all grades of cresylic acid and a rise of 3d. per gal. in carbolic acid (crude 60's). Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—Conditions in the chemical trade in the Manchester district during the past week have been extremely quiet and the markets on the Royal Exchange attracted only a very small attendance. Not only has new business been on a seasonally restricted scale, but there has been a marked contraction in the deliveries of chemical products into consumption against contracts, a good many of the consuming works in and around Manchester having been closed for varying periods during the past week. Prices as a whole, however, have been on a steady basis and in most classes of materials, particularly

the alkalis, the undertone is undoubtedly firm. In the by-products market, also, the demand this week has been quiet but there has been no giving away so far as values are concerned.

GLASGOW.—Business in chemicals has again been rather quiet during the week, both for home trade and export. Prices generally, however, continue quite steady at about previous figures, with no important changes to report. In the coal tar products group the market continues strong in most departments. The demand for cresylic and carbolic acids is well sustained, and continued activity in the consuming industries is anticipated. Competitive offers have been invited for a few spot lots, but no new transactions are reported at prices outside the range quoted. Oils of all grades are moving regularly against contracts and manufacturers appear to have ready outlets for any available fresh production. Less crude benzole is changing hands, but the refined motor quality is moving well. Naphthas are very steady, with the heavy 90/190 grade less easily securable at rates indicated.

General Chemicals

ACETONE.—£45 to £47 per ton.

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £30 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, BORIC.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

ACID, CHROMIC.—9½d. per lb., less 2½%; d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 1s. SCOTLAND: B.P. crystals, 1s. per lb., less 5%, ex store.

ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50: pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £55 per ton ex store.

ACID, SULPHURIC.—168° Tw., £4 5s. to £4 15s. per ton; 140° Tw., arsenic-free, £2 15s. to £3 5s.; 140° Tw., arsenious, £2 10s.

ACID, TARTARIC.—1s. 1½d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1½d. per lb.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 per ton d/d Lancs.; GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £16 10s. (See also Sal ammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Sal ammoniac.)

ANTIMONY OXIDE.—£55 10s. per ton.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish, £17 10s., ex store.

BARIUM CHLORIDE.—£10 per ton. GLASGOW: £11 5s. per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%. £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. GLASGOW: 70/75% solid, £5 10s. per ton net ex store.

CHROMETAN.—Crystals, 2½d. per lb.; liquor, £19 10s. per ton d/d CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. GLASGOW: 99%, £4 7s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£22 10s. per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £5 7s. 6d. to £6 7s. 6d. per cwt. according to quantity; in drums, £5 to £5 13s. 6d.

IODINE.—Resublimed B.P., 5s. 1d. per lb.

LEAD ACETATE.—LONDON: White, £35 10s. per ton; brown, £35.

GLASGOW: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £35 10s.

LEAD NITRATE.—£39 per ton.

LEAD, RED.—SCOTLAND: £37 per ton, less 2½%, carriage paid for 2-ton lots.

LEAD (WHITE SUGAR OF).—GLASGOW: £37 10s. per ton net, ex store.

LITHARGE.—SCOTLAND: Ground, £37 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 10s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 11d. per lb.; powder B.P., 6s. 1d.; bichloride B.P. (corros. sub.) 5s. 2d.; powder B.P. 4s. 10d.; chloride B.P. (calomel), 5s. 11d.; red oxide cryst. (red precip.), 7s.; levig. 6s. 6d.; yellow oxide B.P. 6s. 4d.; persulphate white B.P.C., 6s. 1d.; sulphide black (hyd. sulph. cum sulph. 50%), 6s. For quantities under 112 lb., 1d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PARAFFIN WAX.—SCOTLAND: 3½d. per lb.

PHENOL.—6½d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £40.

POTASSIUM BICHROMATE.—SCOTLAND: 5d. per lb., less 5%, carriage paid.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4½d. per lb. MANCHESTER: £37 10s. per ton.

POTASSIUM IODIDE.—B.P. 4s. 3d. per lb.

POTASSIUM NITRATE.—£27 per ton. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9½d. per lb. SCOTLAND: B.P. Crystals, 9½d. MANCHESTER: B.P. 11d. to 1s.

POTASSIUM PRUSSATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d. to 6¾d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. GLASGOW: Large crystals, in casks, £38.

SALT CAKE.—Unground, spot, £3 16s. 6d. per ton.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£18 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. GLASGOW: £12 15s. per ton in 1 cwt. kegs, £11 per ton in 2-cwt. bags. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. MANCHESTER: 4d. per lb. GLASGOW: 4d., less 5% carriage paid.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags.

SODIUM CHLORATE.—£26 10s. to £30 per ton. GLASGOW: £1 10s. per cwt.
SODIUM CHROMATE.—4d. per lb. d/d U.K.
SODIUM HYPOSULPHATE.—Commercial, 2 ton lots d/d, £10 5s. per ton; photographic, £14 5s. MANCHESTER: Commercial, £10; photographic, £14 10s.
SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £7 15s. per ton for 6-ton lots d/d.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, 9½d. per lb. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—£13 per ton.
SODIUM PRUSSIAN.—4d. per lb. for ton lots. GLASGOW: 5d. to 5½d. ex store. MANCHESTER: 4d. to 4½d.
SODIUM SILICATE.—£9 10s. per ton.
SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 10s.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.
SODIUM SULPHITE.—Pea crystals, spot, £13 5s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
SULPHATE OF COPPER.—£20 per ton, less 2% in casks. MANCHESTER: £22 5s. per ton f.o.b. SCOTLAND: £24 per ton less 5%, Liverpool, in casks.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb., according to quality. Crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.
ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £7 10s. per ton, according to quality.
CADMIUM SULPHIDE.—7s. 2d. to 7s. 5d. per lb.
CARBON BISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.
CARBON BLACK.—3 11/16d. to 4 13/16d. per lb., ex wharf.
CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 1s. 2d. per lb.
DIPHENYLGUANIDINE.—2s. 2d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 4½d. to 5d. per lb.; dark, 3½d. to 4½d. per lb.
LAMP BLACK.—£22 to £23 per ton d/d London; vegetable black, £28 to £48.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE.—30%, £16 10s. to £17 5s. per ton.
SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.
VERMILION.—Pale, or deep, 5s. 3d. per lb., 1-cwt. lots.
ZINC SULPHIDE.—10d. to 11d. per lb., according to quality.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Neutral quality, basis 20.6 per cent. nitrogen, delivered in 6-ton lots to farmer's nearest station, £7 5s. per ton.
CALCIUM CYANAMIDE.—£7 5s. per ton, carriage paid to any railway station in Great Britain in lots of four tons and over.
NITRO-CHALK.—£7 5s. per ton for delivery to end of June.
NITRATE OF SODA.—£7 12s. 6d. per ton for delivery up to end of June.
CONCENTRATED COMPLETE FERTILISERS.—£10 12s. to £11 1s. per ton delivered in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 5s. 1d. to 5s. 2d. per gal.; 99/100%, 4s. 11d. to 5s. 9d., according to specification; pale 99%, 5s. 3d. to 5s. 5d.; dark, 4s. 6d. to 4s. 8d. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. to 4s. 3d.; high boiling acids, 2s. 4d. to 2s. 8d. American specification, 4s. to 4s. 6d. MANCHESTER: Pale, 99/100%, 5s.
ACID, CARBOLIC.—Crystals, 6½d. to 7½d. per lb.; crude, 60's, 4s. to 4s. 3d. per gal. MANCHESTER: Crystals, 8½d. per lb. f.o.b. in drums; crude, 3s. 9d. per gal. GLASGOW: Crude, 60's, 3s. 6d. to 3s. 8d. per gal.; distilled, 60's, 4s. 3d. to 4s. 6d.
BENZOL.—At works, crude, 10d. to 10½d. per gal.; standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4½d. to 1s. 5d.; pure, 1s. 8½d. to 1s. 9d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 5d. to 1s. 5½d.
CREOSOTE.—B.S.I. Specification standard, 6d. per gal. f.o.r. Home, 3½d. d/d. LONDON: 4½d. f.o.r. North: 5d. London. MANCHESTER: 5½d. to 6½d. GLASGOW: B.S.I. Specification, 6d. to 6½d. per gal.; washed oil, 5½d. to 5¾d.; lower sq. gr. oils, 5½d. to 5¾d.
NAPHTHA.—Solvent, 90/160%, 1s. 7d. to 1s. 8d. per gal.; 95/160%, 1s. 8d. to 1s. 9d.; 90/190%, 1s. 2d. to 1s. 3d.

LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 6d. to 6½d. per gal.; 90% 160, 1s. 6½d. to 1s. 7½d., 90% 190, 1s. 1d. to 1s. 2d.
NAPHTHALENE.—Crude, whizzed or hot pressed, £11 to £12 per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £21 to £22 per ton f.o.b.
PYRIDINE.—90/140%, 9s. to 10s. per gal.; 90/180, 2s. 9d. to 3s. 6d. GLASGOW: 90% 140, 9s. to 10s. per gal.; 90% 160, 7s. to 8s.; 90% 180, 2s. 6d.
TOLUOLE.—90%, 2s. to 2s. 1d. per gal.; pure, 2s. 6d. GLASGOW: 90%, 120, 1s. 10d. to 1s. 11d. per gal.
PITCH.—Medium, soft, 36s. to 37s. per ton, in bulk at makers' works. MANCHESTER: 35s. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 32s. to 37s. per ton; in bulk for home trade, 32s. 6d.
XYLOL.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 10s. to £9 per ton; grey, £10 10s. to £11 10s. Liquor, brown, 30° Tw., 6d. to 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11 10s.
CHARCOAL.—£5 15s. to £11 per ton, according to grade and locality.
METHYL ACETONE.—40-50%, £42 to £45 per ton.
WOOD CREOSOTE.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.
WOOD, NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.
WOOD TAR.—£2 10s. to £4 per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID, NAPHTHIONIC.—1s. 8d. per lb.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.
m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-CRESOL 34.5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.
DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—7½d. per lb.
DINITROCHLOROBENZENE, SOLID.—£72 per ton.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 10d.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—9½d. to 9¾d. per lb.; flake, 9½d. to 9¾d.
α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works in casks.
o-NITRANILINE.—3s. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.
o-TOLUIDINE.—10½d. per lb., in 8/10-cwt. drums, drums extra.
p-TOLUIDINE.—1s. 10½d. per lb., in casks.
m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, May 19.—LINSEED OIL was steady. Spot, £32 (small quantities); June to Sept.-Dec., £29 10s.; Jan.-April, £29 15s., naked. SOYA BEAN OIL was dull. Oriental (bulk) afloat, Rotterdam, £23 10s. RAPE OIL was inactive. Crude extracted, £36; technical refined, £37, naked, ex wharf. COTTON OIL was easier. Egyptian crude, £29 10s.; refined common edible, £33 10s.; deodorised, £35 10s.; naked, ex mill (small lots, £1 10s. extra). TURPENTINE was quiet. American, spot, 39s. 3d. per cwt.
HULL.—LINSEED OIL, spot, quoted £30 per ton; May, June-Aug., and Sept.-Dec., £29 10s. COTTON OIL.—Egyptian, crude, spot, £30; edible, refined, spot, £33; technical, spot, £33; deodorised, £35, naked. PALM KERNEL OIL, crude, f.m.q., spot, £26 10s., naked. GROUNDNUT OIL, extracted, spot, £31 10s.; deodorised, £34 10s. RAPE OIL, extracted, spot, £35; refined, £36. SOYA OIL, extracted, spot, £33 10s.; deodorised, £36 10s. per ton. COD OIL, f.o.r. or f.a.s., 27s. 6d. per cwt. in barrels. CASTOR OIL, pharmaceutical, 45s.; first, 40s.; second, 38s. TURPENTINE, American, spot, 40s. 6d. per cwt.

Forthcoming Events

LONDON.

- May 24, 25, 26.—University of London. Course of three lectures on "The Chemistry of the Carotenoids and Vitamin A." Professor I. M. Heilbron. 5.30 p.m. Imperial College of Science and Technology, South Kensington.
- May 26.—Royal Society of Arts. "The Biochemistry of Milk Secretion." Professor H. D. Kay. 8.15 p.m. John Street, Adelphi, London.
- May 26.—Electrodepositors' Technical Society. Spring meeting. Annual election. Fifth William James memorial lecture. W. R. Barclay. 8.15 p.m. Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C.1.
- May 28.—The Physical Society. Ordinary meeting. 5 p.m. Imperial College of Science and Technology, South Kensington.

GLASGOW.

- May 28.—Society of Glass Technology (English and Scottish Sections). Special general meeting and ordinary general meeting. 10 a.m. and 2 p.m. Royal Technical College, George Street, Glasgow.

HEXHAM.

- May 28 & 29.—Society of Chemical Industry. Joint summer meeting of Scottish and Newcastle Sections.

Company News

Chilean Nitrate and Iodine Sales Corporation.—Glyn, Mills and Co. announce that the half-yearly interest payment on the 5 per cent. sterling income debentures will be made on June 30 at the full rate of 2½ per cent.

B. Laporte, Ltd.—The profit for the year ended March 31, including dividends and interests received from investments, after charging directors' fees, making provision for depreciation and doubtful debts and providing a sum for obsolescence, amounts to £92,211, against £94,246 for the previous year. The directors recommend a final dividend at the rate of 17½ per cent. (less income tax) making a total of 22½ per cent. for the year.

Griffiths Hughes Proprietaries.—A final ordinary dividend of 6 per cent., making 11 per cent. for period to June 30, against 17½ per cent., is announced. The profits of the operating company for past year were £234,401 (against £456,678), and after deducting dividends paid and recommended and providing £60,000 for taxation, £20,791 is carried forward by that company (against £17,016).

British Alkaloids.—A profit of £37,766 is announced, against £29,360 for the previous year. The final dividend is 13.12 per cent. on participating preference shares, making 19.12 per cent. (against 15.08 per cent.) and of 21 per cent. on ordinary shares, making 30 (against 22 per cent.). Advertising expenditure amounted to £13,500 (against £10,500); to general reserve £2,000 (against £4,500); to tax reserve £5,125 (against £1,500); forward, subject to directors' extra remuneration, £2,800 (against £681 net).

British Oxygen Co.—A further rise in profits of £147,936 to £591,516 is reported for the year to December 31 last. The corresponding figure for 1935 was £443,580. The directors recommend a scrip bonus of 6½ per cent. and a final dividend of 8 per cent. on the ordinary stock as increased by the bonus issue. The total dividend for the twelve months is thus maintained at 15 per cent., but in 1935 a capital bonus of 28 4-7 per cent. was distributed.

Waxed-Papers.—The directors report a profit of £25,728 (against £17,052). The balance at December 31, 1935, was £22,820. During 1936 £1,000 of this sum was placed to general reserve and preference dividends for two years to June 30, 1931, were paid, leaving £3,070 net, now brought in. The available total is £28,798, of which £4,610 has been capitalised, under a scheme of arrangement in form of additional 7½ per cent. cumulative preference shares. Preference dividend has been paid for half-year to December 31, 1936, and £1,000 placed to general reserve. It is now proposed to pay 10 per cent. on ordinary capital as reduced under the scheme.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British West Indies.—A recently retired civil servant resident in Jamaica is desirous of establishing himself as a manufacturers' agent, and wishes to obtain the representation, on a commission or consignment basis, for Jamaica of United Kingdom manufacturers, exporters, etc., of spirits, drugs, patent medicines, toilet goods and perfumery, surgical goods and appliances, chemicals and essences. (Ref. No. 152.)

New Zealand.—The British Trade Commissioner at Wellington reports that the Public Works Department, New Zealand Government, is calling for tenders (two separate contracts), to be presented in New Zealand by June 29, 1937, for the supply and delivery of the following transformer oil drying and testing apparatus.—(A) Contract P.W. 68/51—1 12 in. portable filter press with drying ovens; 1 7 in. portable filter press with drying ovens; 2 oil testing sets. (B) Contract P.W. 69/21—1 12 in. portable filter press and oven; 1 oil testing set. (Ref. T.Y.2574.)

Belgium.—A technical representative established at Charleroi wishes to obtain representation, on a commission or commission plus travelling expenses basis, of United Kingdom manufacturers of machinery for the metallurgical, electrical and chemical industries, and for breweries and glass works. (Ref. No. 160.)

Brazil.—A firm of commission agents established at Fortaleza, Ceara, wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of machinery and machine tools used in the textile and oil crushing industries. (Ref. No. 169.)

OLEUM (all strengths)

Sulphuric, Battery, Dipping,
Muriatic, Nitric, and Mixed Acids.

SPENCER CHAPMAN & MESSEL Ltd.

With which is amalgamated WILLIAM PEARCE & SONS, Ltd.

WALSINGHAM HOUSE, SEETHING LANE, E.C.3.

Telephone: Royal 1166.

Works: Silvertown E.16

Telegrams: "Hydrochloric Fen, London."

GLYCERINE

We are continuously carrying out research on the application of Glycerine to problems of manufacture. Can our experience assist you?

Write to:

GLYCERINE, LIMITED

Unilever House, Blackfriars, London, E.C.4

Phone: Central 7474
GET 22-354

Telegrams: Glymol, Telex, London

DRYING APPARATUS AND DRYING PLANT

FOR ALL PURPOSES

Complete Chemical Plants

PROCESS — ERECTION — OPERATION

Works: L. A. MITCHELL LTD. Phone:
CARLISLE CHEMICAL ENGINEERS BLA. 7106-7
37 Peter Street, Manchester

BRITISH ASSOCIATION OF CHEMISTS

Unemployment Insurance. Over £11,500 paid out.
Legal Aid. Income Tax Advice. Appointments Bureau

Write for particulars to:—

C. B. WOODLEY, "EMPIRE HOUSE,"
C.R.A., F.I.S.A. 175, PICCADILLY,
General Secretary, B.A.C. LONDON, W.1

'Phone: Regent 6611

